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ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1989

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS UNITED STATES SENATE

ONE HUNDREDTH CONGRESS

SECOND SESSION

ON

H.R. 4567

AN ACT MAKING APPROPRIATIONS FOR ENERGY AND WATER DEVELOPMENT FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1989, AND FOR OTHER PURPOSES

PART 1 (Pages 1-880)

DEPARTMENT OF ENERGY
DEPARTMENT OF THE ARMY
Corps of Engineers
TENNESSEE VALLEY AUTHORITY

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ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1989

WEDNESDAY, MARCH 2, 1988

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, D.C.

The committee met at 2 p.m., in room SD–192, Dirksen Senate Office Building, Hon. J. Bennett Johnston (chairman) presiding.

Present: Senators Johnston, Burdick, Sasser, DeConcini, Hatfield, and Specter.

DEPARTMENT OF THE ARMY—CIVIL

CORPS OF ENGINEERS—CIVIL

STATEMENT OF ROBERT W. PAGE, ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS)

ACCOMPANIED BY:

- JOHN DOYLE, PRINCIPAL DEPUTY ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS)
- LT. GEN. E. R. HEIBERG III, CHIEF, CORPS OF ENGINEERS
- MAJ. GEN. HENRY J. HATCH, DIRECTOR OF CIVIL WORKS
- DON CLUFF, CHIEF, PROGRAMS DIVISION, DIRECTORATE OF CIVIL WORKS

OPENING REMARKS

Senator JOHNSTON. The subcommittee will come to order.

This afternoon, the Energy and Water Development Subcommittee begins its hearings on the fiscal year 1989 budget request for items under our jurisdiction. Today, we are delighted to welcome before the committee the Assistant Secretary of the Army for Civil Works, Mr. Robert W. Page; his principal deputy, Mr. John Doyle; Lt. Gen. E.R. Heiberg III, Chief of Engineers; and Maj. Gen. Henry Hatch, Director of Civil Works, who together will present an overview of the funding requests for 1989.

GENERAL HEIBERG'S RETIREMENT

It is a pleasure to have you gentlemen here this afternoon.

Mr. Page, I know this is your first appearance before us and we look forward to hearing from you. But first I would like to mention the fact that this is, I think, General Heiberg, your last appearance before this committee for the general overview from the Corps of Engineers programs.

General Heiberg, of course, has been the Chief of the Corps now for some time. As Chief and Director of Civil Works, he has worked with this committee through the years.

I must say, General Heiberg, it will be a great loss to the Corps and to the country when you retire. You enjoy the very highest reputation, the very highest esteem from this committee and from the Congress. It will be a great loss to see you leave. We hope you will be around visiting and advising with us even after your May retirement.

I want the record to reflect how outstanding your service has been to the Corps, to the Congress, and to the country.

General HEIBERG. Thank you, sir. I appreciate that.

Senator JOHNSTON. Mr. Page, if you would proceed.

SUMMARY OF STATEMENT

Mr. PAGE. Thank you, Mr. Chairman.

With your indulgence, I would like to add to your complimentary statement about General Heiberg. I think that it is unfortunate, for me personally and certainly for the Office of the Assistant Secretary of the Army for Civil Works, that we are losing such a friend and strong leader.

Being confirmed just 2 months ago, I am just now getting my feet on the ground. And it has been with a great deal of help from General Heiberg and his staff that we have been able to already set some new program initiatives in motion. It is these new initiatives which I wish to discuss in a few minutes.

I would be remiss, however, if I didn't mention that John Doyle, sitting next to me, who is the Principal Deputy, has served in this office much longer than I. He served as acting Assistant Secretary between Bob Dawson, who was my predecessor, and myself. It is with his knowledge that we will probably answer most of your detailed questions today.

FISCAL YEAR 1989 BUDGET REQUEST

We have presented to you a budget which approximates $3.3 billion. As far as my knowledge of the process is concerned, it satisfies all of the parameters which the Assistant Secretary of the Army for Civil Works and the Corps of Engineers use to move the studies and projects through our approval process to the Congress.

We hope and trust that when Congress makes up its fiscal 1989 bill, it will hold the level of spending to what has been proposed by the President because, in my opinion, we have worked diligently toward meeting all program priorities while being fiscally responsible and complying with the bipartisan budget agreement. We have looked closely at the viability of this budget not only from a financial standpoint, but also for meeting the requirements of the American public, the taxpayers, and the subcommittee.

NEW INITIATIVES

In order to execute this budget and to better control future budgets, I will be working with General Heiberg and General Hatch, and also Don Cluff and others of the staff, on internal initiatives which we have started sometime ago in the Corps. We are now refining those initiatives which will allow us to execute our studies and projects in the most proficient manner.

In doing these initiatives, we are hoping to shorten the approval process, to better control the projects through life-cycle project management, and to serve you, the Congress, and the people of this country in giving you a better product in a shorter time, and, we hope, within budget.

We are working on these new initiatives. I think they will be an innovation for the Corps. It will involve taking some of their past procedures and honing them down in the hope that we will eventually get ourselves streamlined to the point that we can meet the demand that will be placed upon the Corps by Public Law 99–662.

PREPARED STATEMENT

If I may enter the formal statement into the record, Mr. Chairman.

Senator JOHNSTON. Without objection.

Mr. PAGE. Being from Texas and wordy as I am, I probably could talk all day long, but I doubt that that would serve the purposes for which we are here today. I do want to thank you for having us here. I want to thank my peers at the table and those behind us for helping us and supporting us in this effort. We are here today to respond to your questions.

Thank you very much, sir.

[The statement follows:]

Statement of Robert W. Page, Assistant Secretary of the Army (Civil Works)

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

INTRODUCTION

I am delighted to appear before your subcommittee today to meet all of you and present the Fiscal Year 1989 budget recommendations for the Civil Works Program of the Army Corps of Engineers. The Chief of Engineers, Lieutenant General E. R. Heiberg III, the Director of Civil Works, Major General Henry J. Hatch, and the Corps Programs Chief, Mr. Don Cluff, are with me and will assist in the presentation of today's testimony. Also present is the Principal Deputy Assistant Secretary, John Doyle, who distinguished himself as Acting Assistant Secretary when my predecessor, Bob Dawson, assumed new responsibilities at the Office of Management and Budget.

Since being sworn in last December, I have had the opportunity of seeing first hand how the Army Corps of Engineers carries out its responsibilities, both here at Headquarters and in the field where the real work gets done. I also have learned of the deep interest which members of this subcommittee have in all aspects of the Civil Works Program. I am counting on that interest not only to sustain - but to further strengthen - the program.

The Water Resources Development Act of 1986, the product of a joint effort by Congress and the Administration, provides a new framework by which water resources projects are formulated and financed. The cost sharing reforms in that Act already are yielding dividends in allowing scarce Federal funds to reach a greater number of projects than otherwise would be possible. Public Law 99-662 is an accomplished fact. In order to more completely respond to project sponsor expectations created by the Act's new planning, engineering, and construction framework, especially in this time of high deficits, we have an obligation to look at every available resource and make it stretch. Therefore, the Army Corps of Engineers must develop new efficiencies in using the funds both Congress and its project partners provide. This is the challenge as I see it.

Our goal over the next several months will be to improve the efficiency with which we do our business. This will be done by:

> Acceleration of the planning, design, and construction process and reducing its cost, including:
  - Streamlining project planning and approval procedures, and
  - Reducing the direct and indirect costs of project planning and implementation;

> Adoption of the project manager concept to carry a project from the feasibility study phase through completion of project construction;

> Monitoring and controlling performance to assure that projects are completed within the costs and schedules agreed to with sponsors; and

> Instituting a construction productivity advancement research program to reduce future project construction costs and, in the process, improve the competitive posture of this Nation's construction industry not only in this country but overseas as well.

My previous experience in private sector construction engineering management should prove useful as the Corps modifies its overall approach to project implementation as a consequence of the sponsor's enhanced role in project planning and implementation. We have already begun to take the necessary steps to meet the future. Some of these steps have been initiated by the Chief of Engineers, and together we will do more. Later in this statement I will address our plan to achieve greater efficiency.

My complete statement addresses these topics:

> Fiscal Year 1988 Appropriations,

> Fiscal Year 1989 Budget Request,

> Efficiency Improvements,

> Proposed Legislation,

> Manpower,

> Management of Foreign Travel, and

> Ownership and Operation of Corps Aircraft.

FISCAL YEAR 1988 APPROPRIATIONS

I think we can all agree that we must get the Nation's economic house in order. That means responsible Federal fiscal constraint - responsible budgeting and program execution in the Executive Branch and responsible legislation and appropriations from Congress. We must all work together if we are to achieve our common goal.

In enacting the Fiscal Year 1988 Energy and Water Development Appropriation Bill, Congress added significantly to the number of studies and projects in the Corps program and increased the level of funding requested by the President for many others. In the spirit of cooperation I mentioned a moment ago, we have distributed those funds to the field activities generally along the lines you proposed. Frankly, we have reservations over some of these projects.

To keep the Civil Works program moving forward, Congress and the Administration must work together to preserve the cost sharing reforms of the Water Resources Development Act and to avoid using Federal funds to construct projects that are uneconomic or more appropriately undertaken by non-Federal interests.

It is my hope that a spirit of cooperation will prevail when the Congress marks-up the Fiscal Year 1989 bill and that you will be successful both at holding the level of spending to that proposed by the President and that you will avoid making cost sharing exceptions and avoid supporting unproductive or inappropriate projects.

FISCAL YEAR 1989 CIVIL WORKS BUDGET REQUEST

The Fiscal Year 1989 budget that I am presenting to you today continues the President's commitment to support responsible national water resources development. Although the program is constrained because of the Fiscal Year 1988 Bipartisan Budget Agreement, I think you will agree it is an extremely good request and fiscally responsible—responsible in the context of balance in the overall Federal program, responsible in the selection of studies, projects and activities funded, and responsible in the level of funding each item receives. I would emphasize that, despite restraint necessary to meet deficit reduction targets, this request includes funding to initiate construction on six projects, including the major commitment of the $1.3 billion Santa Ana, California, flood control project. Let me point out that this budget, while reflecting some internal adjustments, is consistent with the 102 percent cap agreed to last year by Congress and the President.

This budget request marks the first time that the newly established Inland Waterways Users Board has had input into the inland waterways program. Our request for the inland waterways navigation system was formulated taking into consideration the recommendations of the Inland Waterways Users Board. The Board's recommendations were contained in its first annual report entitled Inland Waterways Users Board, First Annual Report to the Secretary of the Army and the United States Congress, dated December 1987.

Inland Waterways Users Board

Section 302 of the Water Resources Development Act of 1986 created an eleven-member advisory board of inland waterway users and shippers to make recommendations to the Secretary of the Army regarding construction and rehabilitation priorities and spending levels for commercial waterway improvements. The Board's overview of the inland waterways system crosses several appropriation accounts - General Investigations; Construction, General; Flood Control, Mississippi River and Tributaries; and Operation and Maintenance, General.

The Board members were appointed in late spring of 1987 and in 1987 held two meetings. The first meeting was on July 15-16, 1987, and the second on September 28, 1987.

The Inland Waterways Users Board should be congratulated for accomplishing so much in such a short time. The Board's recommendations for inland waterways improvements reflect considerable deliberations and insight, on the part of the members, in determining national study, construction, and rehabilitation priorities from the perspective of a user or shipper utilizing these waterways.

In general, with the exception of one feasibility study, the Board agreed with the projects presently in the Army Corps of Engineers inland waterways navigation program. As stated in its report, and discussed at its last meeting, the Board expressed concern about continuing the construction of the Red River Waterway project and has asked for a full briefing at its next meeting. We have tried to the maximum extent possible to accelerate those studies and projects which the Board recommended. Also, we have deferred one navigation study, as recommended in the Board's report. The other study recommended for termination in the report is not in our current program.

The Board's recommendations are a valuable addition to our program development and budget formulation process. We appreciate the contributions of the Board's chairman and members to efficient management and modernization of our inland waterways.

Budget Request Summary

The Fiscal Year 1989 program totals $3.56 billion and is financed principally by a combination of general treasury funds, trust funds, and non-Federal contributions. General funds amount to some $3.1 billion, trust funds to some $0.23 billion, and associated non-Federal contributions to some $0.24 billion. The Federal budget request, summarized by appropriation account, is shown on Table A, attached. Also financing the program are offsetting receipts of some $19 million collected under existing law. Net Federal appropriations would amount to some $3.3 billion.

With the addition of increased non-Federal cost sharing requirements of the Water Resources Development Act of 1986 and the establishment of the two trust funds - Inland Waterways and Harbor Maintenance - approximately 14 percent of our program will be financed by other than general treasury funds. This is remarkable since just two years ago only two percent of our financing came from non-Federal sources. The beneficiary-pay concept, which is the heart of our program, is working well.

Construction, General

Considering the necessity for budget restraint, this is an extremely good budget request and, as is the case for Fiscal Year 1988, it could not have been accomplished without the reforms embodied in the Water Resources Development Act of 1986. Federal and non-Federal investment in the projects and programs funded under Construction, General, total just over $1.4 billion. The construction investment level is slightly greater than our Fiscal Year 1988 request and the Fiscal Year 1988 appropriations. It includes funding of 157 construction projects either started prior to Fiscal Year 1985 or scheduled to be started during the four-year period Fiscal Year 1985 through Fiscal Year 1988 and includes funds to initiate construction for up to five more projects in Fiscal Year 1989. The names and costs of the Fiscal Year 1989 recommended new construction starts are shown on Table B, which also is attached to this statement. Included on this list is the Santa Ana Flood Control project in California, a $1.3 billion project, of which over $1/3 billion will constitute the non-Federal share and will be provided by the three counties who are the project's sponsors. We believe that Santa Ana is a sound, justifiable project. But I make special mention of it here because it will require a major commitment of construction funds in years to come.

The key to sustaining such an investment level is the increased non-Federal share of project costs and the financing of that share during construction. I am pleased to report our record to date on the beneficiary-pay concept for this appropriation account. Of the 57 new start projects funded prior to Fiscal Year 1988 which require local cooperation agreements, 47 have been negotiated and signed. The other 10 are still active and in various stages of negotiation. Moreover, the local cooperation agreements for two of the Fiscal Year 1988 new starts--Mingo Creek, Oklahoma, and Charleston Harbor, South Carolina--have been signed. This demonstrates that local sponsors, our partners, are willing to pay their share to construct projects that are economically and environmentally sound.

A new line item has been established under this appropriation account to reflect funding requirements for the Inland Waterways Users Board expenses and Army Corps of Engineers expenses in support of the Board. The request is for $280,000--$80,000 for the expenses of the Board, and $200,000 for expenses of the Army Corps of Engineers to respond to requests by the Board for data or studies.

Mississippi River and Tributaries

The budget request for the Mississippi River and Tributaries program is $334 million and is about a $17 million increase over the Fiscal Year 1988 appropriation. We are recommending funds to start construction of an $18 million project at Nonconnah Creek in Tennessee and Mississippi and $17.7 million to continue the Yazoo Demonstration Erosion Control program. Also included in the budget for the Mississippi River and Tributaries program are two new preconstruction engineering and design starts.

Operation and Maintenance, General

The Operation and Maintenance, General, appropriation title covers the operation and maintenance of projects and programs for which the Army Corps of Engineers has responsibility, with the exception of those projects included in the Flood Control, Mississippi River and Tributaries program. The Fiscal Year 1989 program request is for $1.37 billion, a decrease of some $27 million below the Fiscal Year 1988 appropriations. Follow-on funding for most of the add-ons in the Fiscal Year 1988 Continuing Resolution and the need to adhere to the Bipartisan Budget Agreement, necessitate a reduction in low priority recreational operation and maintenance, including dredging of some recreational and low use commercial harbors. While we anticipate this reduction to continue in future budget years, increased recreational user fees, beginning in Fiscal Year 1990, would provide the revenue necessary to maintain the program. We are once again seeking enactment of enhanced user fees. Of the $1.37 billion Operation and Maintenance budget, it is anticipated that upward of $156 million in receipts will be available for appropriation from the Harbor Maintenance Trust Fund.

This program request does not include resources for the inspection of non-Federal levees, which has been transferred to the Flood Control and Coastal Emergencies appropriation, or for regulatory functions, which we are reporting as a separate appropriation in response to congressional direction.

General Regulatory Functions

This is a new appropriation account established in accordance with the Fiscal Year 1988 Energy and Water Development Appropriation Act, Public Law 100-202. This function was formerly funded under the Operation and Maintenance, General, appropriation.

The Fiscal Year 1989 budget includes $60.4 million for the general regulatory program. This amount is some $5.2 million over the Fiscal Year 1988 appropriation, but represents only a modest improvement to a program which has held expenditures to $57.2 and $56.1 million during Fiscal Years 1986 and 1987. The regulatory program is very labor intensive, and we may not be able to maintain current staff levels without the requested budget increase. Changes in program responsibilities over the last four year have added to the work done by our regulatory staffs. There are now more procedural requirements on nationwide permits, increased jurisdiction over isolated waters, expanded coordination with other Federal agencies, and additional duties in controlling certain solid wastes. Thus, the universe of regulatory work continues to expand.

This Administration's regulatory reform effort has yielded savings through improved efficiency. We intend to maintain the quality and level of performance that was achieved through much hard work. However, as our universe of work increases and the funding and manpower levels remain relatively stable, we must carefully consider how to proceed.

We understand the need to hold the line on Federal expenditures. We are focusing attention on those items that are essential to carrying out the regulatory mission as mandated by law. This approach already has resulted in a high level of savings with expansion of the general permits program, streamlining the permit evaluation process, and a general reduction of paperwork and redundancy. For the future, we are investigating how we can avoid review duplication by relying more on those state and Federal applicants whose programs are subject to the same laws and executive orders that influence the Federal regulatory decisionmaking process. Additional savings may be achieved by reducing the services we provide to private applicants, who may be required to shoulder additional expense and time in providing information for the evaluation of their applications.

The conference report accompanying the Fiscal Year 1988 Appropriation Act indicates that no further increases in this program will be considered until the Army submits to the appropriate congressional committees a plan to recover expenses of the regulatory program under this appropriation. We are conducting a study on cost recovery and expect to have a plan ready to submit to the committees in time for congressional deliberations on the Fiscal Year 1989 budget. In all probability, implementation would require legislation.

We should note, however, that we have some concern with the concept of full cost recovery in the regulatory program. The benefits the applicants receive from the program are small in comparison to the public benefits of protecting the Nation's waters. The various regulatory authorities we administer are to ensure that permitted developments do not result in unacceptable impacts on the public interest. I will give you a complete report on my views on this subject when we submit our plan.

General Investigations

The budget request for General Investigations consists of a study program that provides for an orderly and steady flow of designed projects, including reconnaissance and feasibility studies through preconstruction engineering and design to the construction program.

Program emphasis on continuing ongoing work, responding to commitments evolving from both the reconnaissance and feasibility phases of project studies, and balancing out our overall Civil Works Program has resulted in a responsible program and a budget request of $129 million for the General Investigations account. The associated non-Federal contributions will add another $14 million to the program.

Language in Section 634 of the Fiscal Year 1988 long-term continuing resolution effectively prohibits use of subsidy-free prices in the evaluation of agricultural development projects during Fiscal Year 1988. This means that we will be unable to properly evaluate the economic merits of such projects and to differentiate sound projects from unsound ones until October of this year. Accordingly, we are postponing our economic evaluations of such projects while proceeding on all other aspects of project development.

General Expenses

The Fiscal Year 1989 budget request for General Expenses is $123.5 million, an increase of $8.3 million above the Fiscal Year 1988 appropriation and $3 million below our Fiscal Year 1988 budget request. This appropriation, which is essentially for personnel and related costs for the executive direction and management of the entire Civil Works Program, includes requirements for the Office of the Chief of Engineers, the 11 Division Offices, and four support centers. The Fiscal Year 1989 request is based on estimates of known requirements, including increased civilian and military personnel compensation; increased rent, communications and utilities costs; and inflation allowance for ADP and office automation, training, supplies, equipment, and equipment maintenance.

EFFICIENCY IMPROVEMENTS

As a result of the Water Resources Development Act of 1986, we believe, for projects planned and constructed under this Act, that some basic organizational and managerial changes are needed. Increased sponsor participation will require that we be responsive to the sponsor's concern about project costs, funding requirements, and flow of benefits. The Office of the Assistant Secretary of the Army for Civil Works is working with the Army Corps of Engineers to implement measures that will enhance the efficiency, productivity, and predictability of the Corps workload. New procedures will be an integral part of the budget and scheduling process. Such improvements, as I stated earlier, will include the following:

Acceleration of Planning and Design Process

STREAMLINED PROJECT PLANNING AND APPROVAL PROCEDURES

In order to respond better to our project partners and Congress, we will implement measures to accelerate the planning and study approval process. We will jointly develop general guidelines for field application which the

District Engineer can follow in order to determine, early on, if the project under preliminary review is or is not a feasible Federal pursuit.

These guidelines will establish field operating parameters. The parameters will provide the District Engineer a better definition of his responsibilities and, thereby, will define an area of authority within which the District Engineer can move more freely. This will allow more freedom and authority in framing the recommended plan and the resulting project, and in addressing the necessary decisions required at District level by the client/community relationship.

REDUCED COST OF PROJECT PLANNING AND IMPLEMENTATION

We want to reduce the time involved in the study review and approval process and to better control project cost, schedule, and budget requirements.

It is our desire to minimize the time between completion of a feasibility report in a District Office and its subsequent submission to Congress. We are continuing to examine the review and approval process to determine how it can be improved. Our analysis has required substantial rethinking and reordering of the roles of the various participants in the planning and review process. This year we will employ a review process on a select group of studies that provides for Departmental review before the District Engineer issues a final report. The objective here is to ensure that the recommended project will enjoy support of all echelons within the Army as it is subjected to the mandatory 90-day state and agency reviews and review by the Board of Engineers for Rivers and Harbors.

Project Manager Concept

Traditionally, the Corps project manager has changed as a project progresses from planning to engineering and design and to construction. In the private sector, a project manager's success depends on assuring project "ownership" and an awareness by all who work on the project that the project manager has the responsibility and the authority to direct and manage all activities on the project. More importantly, the project manager cannot hand off the responsibility for that project until it is completed.

Responsibilities and authorities must be clearly delegated to a project manager whose performance is measured by successful project execution from the feasibility phase to completion of construction.

We intend to build upon the Corps ongoing efforts to improve project management by strengthening and stressing project ownership, accountability, performance measurement, and awareness. Rethinking of relationships among Corps functional divisions and commitment to project "ownership" are needed if we are to improve efficiency through use of the project manager concept.

Controlling Project Costs and Schedules

Our policy must be that we reach agreement on the costs and schedules for the projects at the earliest feasible time. We then will strive to ensure that the projects are constructed within the agreed-to costs and within the agreed-to schedules. This approach to firm cost estimates and schedules is necessary because no one, the Federal Government or project partner, can base a financial plan or budget on a moving target.

Construction Productivity Advancement Research

Another initiative is a new program for construction productivity advancement through research and development. Technological advances in the construction of Civil Works type projects would reduce the Federal investment in the overall construction program.

Based on my experience in the private sector, the level of construction research and development spending, both by government and private industry, has been deficient. This has resulted in a loss of American construction industry competitiveness, not only in this Nation but worldwide as well.

There are substantial opportunities to increase productivity in the construction industry. The United States construction industry traditionally invests little in research. As a result, it has fallen further behind its foreign competition as the differences in technology have increased. The goal of our construction productivity advancement research proposal is to provide cost savings and efficiency directly to the Army Corps of Engineers program, as well as benefit the construction industry in general.

As an initial step, we plan to reprogram $300,000 of the Fiscal Year 1988 research and development program to determine the feasibility of a new construction productivity advancement research program. We envision an industry-government cost shared program that is within the existing mission and authority of the Army Corps of Engineers. Particularly applicable to this initiative is the authority under the Technology Transfer Act of 1986. Execution of appropriate research and demonstrations will be a joint effort by Army Corps of Engineers laboratories, academia, and private firms. The focus of the program would be on four major areas: design, construction technology and equipment, materials, and technology transfer management. The latter would involve a series of demonstration projects.

The reprogramed money would be used to determine the potential for a joint program with the private sector. Research needs and sources of non-Federal financing would be identified jointly by industry and government representatives. The program would be managed by the Army Corps of Engineers. If our initial efforts prove successful, I would anticipate advising this subcommittee and Congress at some later date of our plans to continue the effort within the total General Investigations resources proposed in the Fiscal Year 1989 budget.

PROPOSED LEGISLATION

In keeping with our commitment to a biennial authorization schedule, we have submitted to Congress our 1988 legislative proposals which would authorize new water resources development projects; modify the authorization for one project which exceeds the cost limitations imposed by Public Law 99-662; modify provisions of that Act to make technical corrections; and include other authorities to improve the program.

We hope that the members of this subcommittee will support the new authorizing legislation which we have submitted to Congress. Included in that legislative proposal are provisions that would expand our authority to collect fees for the use of project recreation lands and facilities. The current fee program is limited to the collection of fees for specialized recreation services or facilities, for example, campgrounds. The Corps is currently prohibited from collecting entrance or admission fees by Section 210 of Public Law 90-483. Public Law 93-303 limits the Corps to collection of fees for use of highly developed campgrounds and further provides that one free campground will be provided at each project where camping is permitted. The proposal would eliminate these restrictions and would place the Corps on a comparable basis with other agencies concerning the collection of recreation use fees.

If the legislation is enacted, we will use the anticipated increase in revenue to meet the ever increasing needs of our recreation program at our projects.

MANPOWER

The Corps of Engineers has received a small increase in its manpower allocation in Fiscal Year 1988. The actual increase of only 32 FTE's is the net of a decrease of 138 FTE's for savings expected from A-76 (Contracting Out) studies of 550 FTE's to be studied in Fiscal Year 1988 and an increase of 196 FTE's to manage the greatly increased effort devoted to the Superfund Program in 1988. For the budget year, our target is to perform A-76 studies on 845 FTE's with a projected savings of 180 FTE's. The A-76 program is one of a number of valuable management tools available to enable the Army Civil Works Program to become more efficient, whether or not any work is actually contracted out. The A-76 program, with its built-in protections for current Federal employees, is a proven way for the Government to provide the same level of service at less cost. We are, and intend to remain, in full compliance with Section 8128 of the 1988 Continuing Resolution. We expect a further increase in the EPA Superfund Program requiring another 447 FTE's in Fiscal Year 1989. Our consistent position has been that additional resources required to support EPA's Superfund Program, a task the Corps is uniquely qualified to perform, need to be made available so that this effort does not detract from the execution of the Civil Works Program. This is especially important in recognition of the fact that the Water Resources Development Act of 1986 has produced an increased workload--especially in the labor intensive planning and design activities. The Office of Management and Budget has agreed with this position and has provided additional personnel allocations to allow Corps support to the EPA Superfund Program.

MANAGEMENT OF FOREIGN TRAVEL

I would like to update this subcommittee on foreign travel by the Corps of Engineers and to discuss some related matters.

Civil Works funded foreign travel by the Army Corps of Engineers is associated with the following international activities:

- > Activities in support of U.S. treaty commitments with foreign governments;
- > Activities in support of specific water development projects overseas authorized by the United States Congress;
- > Activities in support of executive agreements with foreign government agencies, approved by the Department of State, related to mutually beneficial scientific and technical exchanges;
- > Activities related to international reimbursable technical assistance projects;
- > Activities related to foreign research and development contracts;
- > Participation on behalf of the U.S. Government in various international organizations; and
- > Attendance by Army Corps scientists and engineers at international conferences, workshops, and meetings of international professional organizations.

During the past fiscal year, Mr. Chairman, the Corps of Engineers spent $274,781 on foreign travel. This comes close to, but is still within, the $276,662 limitation set forth in House Report 99-670. A detailed statement of Corps of Engineers Civil Works funded foreign travel during Fiscal Year 1987 is being provided to the subcommittee, which I ask be included in the record of this hearing. The Corps is managing foreign travel in Fiscal Year 1988 within a travel limitation—the same limitation which was used for Fiscal Year 1987. However, I have agreed that consideration will be given to making an inflationary adjustment and, after consideration of the Corps recommendation, I will provide an appropriate adjustment for inflation.

We also are refining and improving our procedures and controls on foreign travel to further ensure that Corps foreign travel and related foreign activities are consistent with all applicable Office of the Assistant

Secretary of the Army (Civil Works), Army, Department of Defense, and other U.S. Government policies. In addition, we are making a special effort to carefully examine travel which the Corps classifies as "routine operational" to ensure that that type of travel fully conforms with all applicable rules, regulations, and U.S. Government policies. I believe the scrutiny being given this category is appropriate and trust that it meets with the subcommittee's approval. At the same time, we also are working to make the foreign travel approval process more efficient and effective and to reduce paperwork to the absolute minimum.

OWNERSHIP AND OPERATION OF CORPS AIRCRAFT

The Administration is proposing in Fiscal Year 1989 to dispose of approximately $13 million in Government assets. Tentatively included on the list of assets to be sold is the Corps of Engineers Headquarters aircraft. In keeping with the statutory language contained a few months ago in the Continuing Resolution on this subject, no effort will be made during the current fiscal year to sell this aircraft. While the 1989 budget assumes the sale of this asset, a final decision within the Administration on whether or not to sell the Headquarters aircraft in Fiscal Year 1989 will be made following the Administration's review of recent studies on the aircraft and the potential for improved efficiency that might be obtained through joint scheduling of the use of this aircraft in conjunction with other Army aircraft.

CONCLUSION

The Fiscal Year 1989 budget shows strong Presidential support for the Civil Works Program of the Army Corps of Engineers.

The efficiency improvements we propose will allow projects to move through planning, design, and construction without many of the delays we have experienced in the past. Studies and projects will be completed on schedule and within agreed-to project costs.

Early decisions will be made as to the future Federal interest on all studies and projects. Project partners and Congress will have increased confidence that, once a commitment is made, there will be a much greater likelihood of a study or project being completed.

The Corps, in my judgment, is an outstanding organization with exceptional planning, engineering and design, and construction capabilities. The times, however, necessitate new operational improvements and efficiencies, ones that should add to the Corps well-deserved reputation. We are committed to enhancing the credibility of the Civil Works Program with Congress and the Administration that is necessary for effective competition for scarce budgetary and personnel resources.

This completes my statement, Mr. Chairman.

TABLE A
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS - CIVIL WORKS
FISCAL YEAR 1989 CIVIL WORKS PROGRAM
(Dollars in Thousands)

APPROPRIATION TITLE	FEDERAL FUNDS: TRUST FUNDS: INLAND WATERWAY	FEDERAL FUNDS: TRUST FUNDS: HARBOR MAINTENANCE	FEDERAL FUNDS: GENERAL FUNDS	TOTAL FEDERAL BUDGET REQUEST	NON-FEDERAL FUNDS: RIVERS AND HARBORS CONTRIBUTED FUNDS a/: AUTHORIZED	NON-FEDERAL FUNDS: RIVERS AND HARBORS CONTRIBUTED FUNDS a/: ANCILLARY	NON-FEDERAL FUNDS: RIVERS AND HARBORS CONTRIBUTED FUNDS a/: TOTAL	TOTAL PROGRAM FUNDING
GENERAL INVESTIGATIONS	-	-	129,271	129,271	14,000	50	14,050	143,321
CONSTRUCTION, GENERAL	77,467	-	1,150,103	1,227,570	185,000	35,000	220,000	1,447,570
OPERATION AND MAINTENANCE, GENERAL b/	-	156,000	1,216,894	1,372,894	3,900	2,800	6,700	1,379,594
GENERAL REGULATORY FUNCTIONS	-	-	60,427	60,427	-	-	0	60,427
F.C., MISSISSIPPI RIVER & TRIB'S	-	-	334,297	334,297	50	200	250	334,547
GENERAL EXPENSES	-	-	123,465	123,465	-	-	0	123,465
F.C. & COASTAL EMERGENCIES	-	-	25,000	25,000	-	-	0	25,000
REVOLVING FUND	-	-	35,174	35,174	-	-	0	35,174
PERMANENT APPROPRIATIONS	-	-	9,000	9,000	-	-	0	9,000
TOTAL	77,467	156,000	3,083,631	3,317,098	202,950	38,050	241,000	3,558,098
OFFSETTING RECEIPTS:								
UNDER EXISTING LAW	-	-	19,100	19,100				
NET TOTAL	77,467	156,000	3,064,531	3,297,998				

a/ Authorized - The non-Federal cash contribution required under terms of existing and proposed agreements.
Ancillary - Estimated cost of unauthorized work requested by non-Federal interests and done on a reimbursable basis.

b/ Includes $15.0 million to be derived from the Special Recreation Use Fee account. The $20.0 million anticipated to be derived from proposed increased recreation use fee legislation would be available for use, starting in FY 1990 if enacted in FY 1989.

TABLE B
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS - CIVIL WORKS
FISCAL YEAR 1989 CIVIL WORKS PROGRAM
(Dollars in Thousands)

APPROPRIATION AND PROJECT NAME	STATE	BUDGET REQUEST	TOTAL FIRST COST	FINANCING FEDERAL	FINANCING NON-FEDERAL
CONSTRUCTION, GENERAL					
CACHE CREEK SETTLING BASIN	CA	3,250	21,200	15,600	5,600
SANTA ANA RIVER MAINSTEM	CA	15,000	1,295,000	941,000	354,000
SHEYENNE RIVER, WEST FARGO/RIVERSIDE	ND	2,700	21,700	13,900	7,800
RAMAPO AND MAHWAH RIVERS, MAHWAH AND SUFFEREN	NJ & NY	300	7,910	5,930	1,980
LOCK HAVEN	PA	1,000	78,700	58,500	20,200
SUBTOTAL FOR 5 PROJECTS		22,250	1,424,510	1,034,930	389,580
FLOOD CONTROL, MISSISSIPPI RIVER AND TRIBUTARIES					
NONCONNAH CREEK	TN & MS	1,500	18,100	13,600	4,500
SUBTOTAL FOR 1 PROJECT		1,500	18,100	13,600	4,500
TOTAL FOR 6 PROJECTS		23,750	1,442,610	1,048,530	394,080
AS A PERCENT OF TOTAL FIRST COST			100.00%	72.68%	27.32%

STATEMENT OF LT. GEN. E.R. HEIBERG, CHIEF OF ENGINEERS

Senator JOHNSTON. Thank you very much, Mr. Page. We are delighted to have you here.

Now, General Heiberg has a statement and then we will go to questions.

General HEIBERG. Thank you, Senator.

I would like to do as Mr. Page did, be brief. I have also brought a prepared, written statement that I would like to put into the record.

I am pleased again to appear before the subcommittee. As you noted, I have appeared here in several different capacities since 1976, and I expect this afternoon to be a far more enlightening experience than occurred in the Rayburn Building 2 days ago.

This will be the last time I come before you as Chief of Engineers, as you noted, Mr. Chairman, unless you recall me. With your permission, I will take a brief look at the Army Civil Works program, what it has meant to the nation, and the direction that I see it moving in the years to come. Then I will provide a brief extension of Mr. Page's remarks on the 1989 budget request as the basis for further discussion.

INVESTMENT IN CIVIL WORKS PROGRAM

Since 1824, the Congress has invested almost $70 billion in Corps of Engineers water resource projects and programs. Those have been your dollars, but what this nation has received in return for that investment has been truly impressive.

We built over 400 major flood control lakes, which we operate, and over 1,700 local protection projects that have been turned over to local authorities for their operation and maintenance. Collectively, these projects have prevented over $160 billion in flood losses in the just the past decade and a half. This is far more than the amount that taxpayers have invested in all the flood control projects over the last 50 years, and they are still operating. Unfortunately, we cannot measure the worth of lives saved or the lives made better, but that dimension is also there, and it may be a better measure of the value of those projects if we had that yardstick.

We also have developed and maintained a huge network of commercially navigable inland and coastal waterways for almost 500 ports and harbors. These projects provide for inland and ocean vessels, safe, low cost transportation, and energy efficient movement of commodities. I have to also note that the existence of the barge transport mode itself provides a huge competition factor that benefits all of our customers.

I will not take the time to discuss our work as the nation's No. 1 hydropower producer, our provision of water supply, or our immense contribution as the nation's No. 2 outdoor recreation agency. But they, too, provide significant contributions to the nation's well-being.

INTERNAL CHANGES

I do take pride with the Army and this committee that our water resources program emphasizes a proven return on the taxpayers' investment. The fact that the benefits accruing to our projects have far exceeded the financial investment is one of the basic reasons why our program enjoys strong support, and in the wake of the water resource development of 1986, an even closer working relationship with the project sponsors.

As we begin to implement this new law, we see clearly that our internal operational and management procedures must adjust if we are going to be truly responsive to the objectives and priorities of our study and our project sponsors.

Secretary Page has discussed initiatives for the Civil Works program. I want to emphasize that these are our initiatives. General Hatch and I have worked with him on those, and they are joint efforts. They are going to build on our past efforts to improve our total program. They will also address concerns expressed by our project sponsors and Congress over the accuracy of project cost estimates and the need for quicker project implementation.

BUDGET HIGHLIGHTS

A few words on this year's budget request. As Secretary Page stated, this is a remarkably good budget given the national concern over budget deficits. We continue to focus our priorities on navigation and flood control. Overall, our budget request, as he noted, totals about $3.3 billion of federal dollars, the highest level for our program since fiscal year 1983, and 2 percent higher than our fiscal year 1988 appropriations.

Let me mention a few highlights. The budget request for General Investigations, what we call GI, is $129 million. This will permit initiation of 20 reconnaissance phase studies compared with 16 in last year's budget. We are also continuing the new preconstruction engineering and design program that we began in fiscal year 1988. Under this program, projects for which feasibility studies are almost complete can be funded for the design stage as quickly as possible. This saves us valuable time while the feasibility reports are reviewed for construction authorizations.

For fiscal year 1989, the budget for Construction, General asks for $1.23 billion in new budget authority. That includes five new construction starts. The Construction, General account also includes a new initiative from the Water Development Act of 1986, which authorizes the cost-share placement of dredged materials on beaches. Each state making such a request must agree to pay for 50 percent of the increased cost to the Corps for the placing of the sand.

The budget request for Operation and Maintenance General is $1.37 billion. That programs meets our highest priority needs but there will be reductions in two lower priority categories—the dredging of recreation and low-use commercial harbors, and the operation and maintenance of some of our recreation sites.

Our budget for the Mississippi River and tributaries project is a third of a billion dollars. It includes one new construction start and two new design starts.

We are asking for $123 million to fund the executive direction and management of the Civil Works program. This request is only $8 million over fiscal year 1988 appropriation, which itself represented a cut of $13 million. We need to fund several costs over which we have no control plus a one-time mandate of expense nearly $1 million for telephone equipment. With all the increased emphasis on the need to develop new policy and guidance and undertake new management initiatives, we do need some funding relief for this account in fiscal year 1989.

CORPS HEADQUARTERS MOVE TO FORT BELVOIR

As I have mentioned in past years to this committee, the Corps headquarters is going to move outside the beltway, hopefully in 1990. We are likely to locate at Humphrey's Engineering Center, which is about 12 miles south of this hearing room as the crow flies. We are hammering out the details of that move now.

However, when we do move, we plan to leave a contingent of our water resource staff in the downtown area to interface with Congress, the OMB, and other agencies and organizations. The Assistant Chief of Engineers, who represents my military responsibilities, will remain in the Pentagon. So the Chief himself will keep at least one foot in the Pentagon.

WATER RESOURCES DEVELOPMENT ACT OF 1986

To summarize, sir, the provisions in the Water Resources Development Act of 1986 provide opportunities to enhance the efficiency, productivity, and predictability of the Civil Works program. The fiscal year 1988 budget summit agreement further underscores the need to look for ways to improve efficiency. We will continue to find ways to do that.

The administration and the Congress have settled the major questions on what is the federal role in water resources development. What we need to do is to allow our field staff, in coordination with our many local project partners, to implement the new role.

As I retire from the Corps of Engineers, I take a great deal of satisfaction on our work together. Corps leaders, both civilian and military, and we have a number of them here today, are superb, and they represent a superb cadre. I am constantly impressed that we continue to attract such quality men and women to the Corps of Engineers.

I have watched the Senate and the House, or at least much of it, the Secretary of Defense and the Secretary of the Army, and the generals who run the field Army, share in this pride that I have gained in 35 years in the free world's largest and best engineering agency.

My greatest pride and satisfaction comes from the knowledge that I will leave to my successor, in addition to the Douglas MacArthur castles I am wearing today, an organization that is prepared and superbly qualified to address the future water resource needs of this nation, as well as its defense. Thank you, sir.

[The statement follows:]

STATEMENT OF LT. GEN. E.R. HEIBERG III, CHIEF OF ENGINEERS, U.S. ARMY CORPS OF ENGINEERS

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

INTRODUCTION

It is my pleasure to appear before this Subcommittee and to present, along with the Assistant Secretary of the Army for Civil Works, Mr. Robert W. Page, the Fiscal Year 1989 budget recommendations for the Civil Works Program of the Army Corps of Engineers.

I have been before this Subcommittee on numerous occasions since the 1970's to make the case for a strong, rigorous, economically sound and environmentally sensitive program to meet the Nation's water resources needs. I am proud of my involvement with the Nation's water resources program, which dates back to 1955 when I was a Lieutenant in the Corps of Engineers New England Division; and continued when I became commander of the New Orleans District in 1974. Since then I have been privileged to serve as Ohio River Division Engineer, Director of Civil Works, Deputy Chief of Engineers, and, since September 1984, Chief of Engineers.

This year's budget cycle marks the last occasion at which I expect to appear before you as an active duty officer. I will be passing the flag to my successor as Chief of Engineers on the 5th of May; and, although I have no word yet on who that fortunate individual will be, I am pleased to say that, with this Subcommittee's help and support, he will find the Army's Civil Works program in a far more viable state than was the case in previous years. And I can assure him, and you, that he will have the finest team of professionals - and I do not mean just engineers, but all 40,000 people who are part of the U.S. Army Corps of Engineers - to support him in his task of "providing quality, responsive engineering service to the Nation in peace and war."

Over the years, the Corps of Engineers, as part of the Executive Branch of government, has developed a creative partnership with the Congress - and particularly with this Subcommittee - to meet the Nation's water resource needs. We have not always agreed; as the saying goes, "when two people agree on everything, one of them is unnecessary." But where we have disagreed, it has been over the means to achieve our common ultimate goal; and from the give and take fostered by those disagreements, as well as from the far more numerous cases in which we have agreed, has come the consensus - and the credibility - that underlies our entire water resources program.

Since this will be my last opportunity to come before you as Chief of Engineers, I would like, with your permission, Mr. Chairman, to take a look at the Army's Civil Works Program, what it has meant to the Nation, the direction in which it has moved over the past 10 years and the direction in which I see it moving in the years ahead; and then provide a summary of the President's 1989 budget request.

VALUE OF WATER RESOURCES INVESTMENT TO THE NATION

The Nation has invested through the Civil Works program almost $70 billion in the planning, design, construction, operation and maintenance of water resources projects and other programs. Although this investment appears large, it is very small in comparison to the Federal expenditures for many other programs. This fiscal year, for example, Civil Works expenditures will be about three-tenths of one percent of the total Federal budget, a minuscule amount when compared to the importance water has to this nation -- to our commerce, to the quality of our lives, and to our grandchildren.

FLOOD CONTROL

The dual concern for development of the physical wealth of our country and the need for protecting human life from uncontrolled flooding provided the basic incentive for expanding the Corps role in water resources development. Congress enacted legislation particularly in the late '20's and '30's directing the Army Corps of Engineers to study and implement flood control works throughout the Nation.

Over the past 50 years about $23 billion has been invested through our programs in flood control projects. These works include over 400 major flood control lakes operated by us and over 1,700 local protection projects that have been constructed and turned over to local authorities for operation and maintenance. Collectively, these projects have prevented over $160 billion in flood losses over the past 15 years. This is more than 7 times the amount invested in constructing all flood control projects in the past 50 years. And each year additional benefits are realized. For example, during Fiscal Year 1986 and 1987, Corps projects and flood fight efforts prevented an estimated $27 and $5 billion in flood damages, respectively. Even when these numbers are adjusted for inflation, the reality is clear: the investment in flood control is highly productive, and it is this production that provides the basis for non-federal participation in Civil Works projects.

NAVIGATION

Early in this century the Congress concluded that the Federal Government also needed to become more heavily involved in the development of the nation's transportation system if this country was to develop economically. So in 1927, they authorized the Corps to survey the country's navigable streams and to plan for the comprehensive development of waterborne navigation and hydropower, in addition to flood control. Through the years

Congress has authorized thousands of individual studies and projects to carry out this mandate.

The Corps has expended over $11 billion throughout the country for the development of the nation's inland and coastal waterways, and its ports and harbors. More than 25,000 miles of commercially navigable waterways have been developed and are maintained at a current annual cost of about $400 million. Facilitated by locks and dams at over 200 sites, some 1.8 billion tons of commodities move along these waterways.

Navigational waterways provide safe, low-cost transportation, and energy-efficient movement of commodities, and serve as a vital link in the nation's intermodal transportation system. In addition to their commerical use, the navigation system is important to maintaining our competitive edge for bulk commodities in world markets and is a vital link in our defense readiness capability. Given this important commercial transportation role, it is well within the capability of inland waterway navigation users and sponsors of our harbors to contribute to the cost of modernization of our navigation channels and waterways.

HYDROPOWER

In meeting needs of this nation the Corps has taken advantage of the hydroelectric power generating capabilities of its projects. Since those early years, we have constructed over 70 multiple purpose projects with hydroelectric installations. The installed generating capacity of these projects totals almost 20 million kilowatts. This represents about one-third of the nation's developed hydroelectric capacity and about three percent of the current national generating capacity from all sources. The energy produced by these projects reduces our dependence on other non-renewable resources such as oil and coal. Fortunately, we can look to the private sector to finance future projects, thus leaving scarce Federal dollars for the Corps main line missions of flood control and commercial navigation.

OTHER OUTPUTS

As the country developed, needs changed and the Nation became aware of the full value of the water resources development for assisting the State and local government in meeting their needs for domestic water supply and outdoor recreation activities. As a result, storage and facilities for these needs have been incorporated into the planning and construction of our projects.

Currently, about 9.5 million acre-feet of water supply storage is impounded in some 106 Corps multiple purpose reservoirs and 6 more are under construction. The storage provides some 4.5 billion gallons of water per day, serving about 5 million persons through augmentation of municipal, industrial and rural water supply sources.

Development of over 4,000 recreation areas at our projects has attracted many visitors with over 500 million visitor-days of use recorded annually. This places us as the second "most visited" federal agency behind only the National Forest Service. As proposed in the Department of the Army's legislative package, enactment of recreation user fees would help us better maintain our investment in recreation facilities.

PERSPECTIVE

Institutionally, the water resources programs are unique when compared to most other types of Federal investments. Normally, investments are authorized by Congress specifically on the basis of anticipated return on the investment, but only after a thorough review of the environmental and other impacts attributable to such developments. No other program gets more scrutiny. I do not decry these tests -- in fact I am proud of them. This intense review helps assure us that our projects provide an improved quality of life for all Americans. Projects are designed and operated to take advantage of the opportunities for the wise management and protection of the quality of water and associated land resources. Therefore, I urge Congress to rely on the orderly review of projects by the Executive Branch. We are all committed to reducing the time it takes to review our projects.

Often overlooked, too, is the Corps mobilization capability for the national defense and critical emergency operations. This capacity serves the nation well, particularly during periods of natural disaster. Our ability to rapidly mobilize skilled and experienced professionals is a facet of the Civil Works program that is of extremely significant value to the nation.

1976 TO THE PRESENT

The Civil Works program has a proud history. Our activities undertaken during the past twelve years as part of three Administrations and in conjunction with seven Congresses have faced new and significant challenges. These challenges came about in a large part because of a National concern over the protection of the environment and growing concern over budget deficits. Mr. Chairman, with your permission, I will show how the Administration, Congress and this Subcommittee utilized the Corps to meet these challenges. It is a story of perseverance, strength, and vision, and ultimately a recognition of the importance of change for the good of the Nation.

After 1976, Congress abandoned the practice of enacting authorization acts on a two-year cycle. It would be ten years later, 1986, that the next authorization act could be passed. This ten year period, 1976 to 1986, was a time of uncertainty not only for the Corps of Engineers, but also for the Administration, Congress, the general public, and State officials.

During the 1970's the Nation became concerned over the impacts of water resources projects on the environment. Some of our projects under construction were stopped, and some never completed. Many projects in the planning and design stage were reformulated to obtain a different balance between economic returns and environmental considerations. To meet the challenge, we rewrote our planning guidelines to more fully accommodate environmental concerns and to include environmental features, where now appropriate, in our project designs.

Then came the 1980's and with them growing concerns over the budget deficits and a reassessment of the Federal role in many national programs. That relook included water resources development. The Administration proposed removing government from competition with the private sector and promoted the "user pay" philosophy. The Congress focused on the level and scope of services the Federal Government should provide. Both branches of government worked together to resolve their differences. However, the impasse extended over a six year period during which the Administration and this subcommittee became increasingly concerned over the growing delay in starting needed projects. In an attempt to break the deadlock, the President submitted the Fiscal Year 1983 new starts budget amendment. Then in Fiscal Year 1985, the Subcommittee included in a Supplemental Appropriation Bill the funding of 41 new construction starts with implementation based on enhanced cost-sharing and financing proposed by the Department of the Army. The Bill's passage allowed the Civil Works program to function until agreement on a new Federal policy was reached. The 1983 budget amendment and 1985 Supplemental Bill certainly helped to point the way.

On November 17, 1986, the Water Resources Development Act of 1986 was passed and signed into law, a landmark legislation for our program. The Act authorized numerous new projects and, perhaps more importantly, new user fees and cost-sharing requirements for financing water resources projects. It was gratifying that needed program reforms now had the backing of both Houses of Congress and the Administration, and we could move forward to implementing this vital program. The blinking red light had finally turned to green.

To keep the Civil Works program moving forward, Congress and the Administration must work together to preserve the reforms of the Water Resources Development Act. Cost-sharing, for example, is enabling Federal funds to reach a greater number of projects than otherwise would be possible. In this era of budgetary constraint, we simply cannot afford to make exceptions to cost-sharing. Likewise we must avoid using Federal funds to construct projects that are uneconomic or more appropriately should be undertaken by non-Federal interests.

RECENT ACCOMPLISHMENTS

Yet even though the 70's and 80's were marked by uncertainty, the Corps Civil Works program did manage to make some important contributions.

This was possible because the Administration and Congress, although rethinking the specifics of the Federal role, agreed that the program was too important to the Nation to let it languish.

Even though it was ten years between Acts, '76 to '86, we managed to accomplish some significant milestones, including:

- The construction of the Lock and Dam 26 replacement which is well underway. The project is the key to the total Mississippi River navigation system. It will restore efficient navigation on the Upper Mississippi River by removing its major bottleneck.
- The completion of the Tennessee-Tombigbee Waterway. This 234-mile waterway links the Tennessee and Tombigbee Rivers, a vital route from the heartland of America to the Gulf of Mexico. It has a value I believe that will not be fully recognized for a few years, but in the long run will prove to be a most foresighted investment.
- Completion of the Old River Auxiliary Control Structure on the Mississippi River. This vital structure reduces flood damages, augments fresh water flows to the Atchafalaya basin and guarantees the navigation course of the Mississippi River through the Port of New Orleans.

In addition to constructing projects, the Corps carried out some significant programs and studies. These efforts reflects the varied nature of the Corps contribution to the Nation and include:

- Completing of the National Program of Inspection of Non-Federal Dams. More than 8,800 dams were inspected and safety deficiencies were found in over 2,700, including about 130 in need of immediate attention. The spotlight on unsafe dams was a vital contribution to the safety of many Americans.
- Reforming the Section 404 Regulatory Program. We simplified procedures, removed overlapping jurisdictions, expanded the number of regional or nationwide permits for certain activities and, in general, shortened the time and reduced the effort required to obtain a permit.
- Providing through our "Work For Others" program, engineering and construction support to the Environmental Protection Agency for both the Superfund and the Construction Grants wastewater treatment programs. This work is funded by EPA and OMB has authorized the necessary additional manpower. These two programs enable us to sharpen our technical skills and, at the same time, continue our commitment to provide badly needed environmental repairs to our Nation's lands and waters.
- Initiating a program to rehabilitate as well as improve the operating efficiencies of the country's inland waterways system. We also are involved in improving the Nation's system of harbors and ports and making them more competive in the movements of commodities into and out of this country.
- Completing the special assignment which President Reagan gave the Corps following the initial $1/4 billion clean-up operation undertaken in the aftermath of the disaster created by the eruption of Mount St. Helens in May 1980. Following the clean-up operation, one of the largest

disaster response efforts ever undertaken by the Corps, the Corps planned and is now implementing a permanent solution to the flood problems.

- o Undertaking the special Louisiana Wetlands Study. It is a vital and important study effort. This work will assess the importance of the wetlands to coastal Louisiana and what this Nation must do to protect them.

CURRENT PROGRAM

Mr. Chairman, the remainder of my presentation will be directed to the Corps current and budgeted program.

The Assistant Secretary has focused on his goals for further improving the efficiency of the Army Corps of Engineers and has provided a brief overview of our Fiscal Year 1989 program and budget request. I will focus on:

- o Efficiency Improvements;
- o Fiscal Year 1989 program highlights by major appropriation account;
- o The planned move to Fort Belvoir;
- o General Regulatory Functions; and,
- o Construction Productivity Advancement Research.

EFFICIENCY IMPROVEMENTS

It was clear early on that the Corps would have to undergo internal adjustments to respond to the new challenges presented by increased cost-sharing and other provisions contained in the Water Resources Development Act of 1986. In addition, the prospect of future funding reductions suggested that we review all of our operations to determine if we could carry out our responsibilities in even a more efficient manner.

The Assistant Secretary, in testimony, has discussed initiatives for the Civil Works program. I stand squarely in support of those initiatives and they are ours. Our common goal is to embark on measures that will build on our past efforts on improving efficiency, productivity, and predictability of our workload. We and our staffs have been working hard to translate these initiatives into working procedures. We are in this together and Assistant Secretary Page and I both hope we can count on this Subcommittee's encouragement and support in our program of efficiency improvement.

We also are addressing concerns expressed by our project sponsors and Congress on the accuracy of project cost estimates and quicker project implementation. We are committed to a number of steps, including taking advantage of demonstration and test programs which are underway to improve our procedures and processes. We are committed to finding the best way to achieve the goals of improved efficiency which we all clearly desire.

FISCAL YEAR 1989 BUDGET REQUEST

As Assistant Secretary Page stated, this is a remarkably good budget given the national concern over budget deficits. The Administration recognizes the need to continue the development of this Nation's water resources in the principal areas of navigation and flood control.

The budget is based on the reforms embodied in the Water Resources Development Act of 1986 and our collective efforts to implement the reforms equitably and consistently. Overall our budget request totals some $3.3 billion, an amount which is supplemented by nearly $1/4 billion in contributed funds from our project sponsors. I have provided detailed funding information on the table attached to this statement which compares the funding levels by individual appropriation titles for the period Fiscal Year 1987 thru 1989. Now, with your permission, Mr. Chairman, I will give some overall highlights of our budget.

GENERAL INVESTIGATIONS

The budget request for General Investigations account is $129 million. The program also includes additional non-federal contributions of $14 million for feasibility phase studies.

The study program includes funds to initiate 20 new reconnaissance phase studies, an increase of four above last year's budget. They will be addressing critical water resources needs throughout the Nation.

Our request for coordination with other agencies includes a new item called Interagency Water Resources Development. The new item will provide for activities such as meetings with communities and other sponsors who may wish to participate in future studies. Previously, this effort was included in study specific appropriations or distributed to all work via the overhead account. However, the advent of cost-sharing in the General Investigations program requires a more accurate accounting of such costs. The budget includes $1 million for this activity.

We are also continuing the implementation of the new Preconstruction Engineering and Design Program initiated in Fiscal Year 1988. With this program, projects advance from the feasibility phase to the Preconstruction Engineering and Design phase as quickly as possible, by funding these projects as their feasibility reports are being reviewed for submittal to Congress for construction authorization.

CONSTRUCTION, GENERAL

For Fiscal Year 1989, the budget for Construction, General is $1.23 billion in new budget authority and includes $77 million from the Inland Waterways Trust Fund. Despite the constraints set by the recent Bipartisan Budget Agreement, the budget request includes funds to initiate five new construction starts, including the $1.3 billion Santa Ana flood control project in California.

In addition, it provides for a new start program through Fiscal Year 1993.

The Construction, General account also includes a new initiative, the implementation of Section 933 of the Water Resources Development Act of 1986 which authorizes cost-shared placement of dredged materials on beaches. We have budgeted $1 million for the Federal share of incremental dredged material placement for projects which may be approved under this program during Fiscal Year 1989. These funds will be used to place beach quality sand, a product of our dredging and maintenance activities on navigation inlets and channels, on beaches of States which make a formal request. Also, each state making such a request must agree to pay for 50 percent of the increased cost to the Corps of placing of the sand in such a manner.

The Water Resources Development Act of 1986 increased the Federal cost ceilings of several authorities within our Continuing Authorities Program. With increased ceilings, we expect that future projects will be larger and more numerous; there will be a greater utilization of the program over the years. With a greater use of the program, we would also expect a similar reduction from the specifically authorized program.

OPERATION AND MAINTENANCE, GENERAL

The budget request for Operation and Maintenance, General, totals $1.37 billion. It includes $15 million from the Special Recreation Use Fee account, and $156 million from the Harbor Maintenance Trust Fund. The program we have laid out meets our highest priority needs. Follow-on funding for most of the add-ons in the Fiscal Year 1988 Continuing Resolution, and the need to adhere to the Bipartisan Budget Agreement, however, necessitate a reduction in low priority recreational operation and maintenance, including dredging of some recreational and low use commercial harbors. We would anticipate this reduction to continue in future budget years. However, increased recreational user fees, beginning in Fiscal Year 1990, would provide the revenue necessary to maintain the recreation program. We are once again seeking enactment of enhanced user fees as part of the new authorization legislation that we have submitted to the Congress.

FLOOD CONTROL, MISSISSIPPI RIVER AND TRIBUTARIES

Our budget for the Flood Control, Mississippi River and Tributaries is $334 million. It includes one new construction start and two new preconstruction engineering and design starts. Of this amount, $4 million is for General Investigations, $219 million is for Construction, and, $111 million is for Operation and Maintenance.

GENERAL EXPENSES

We are asking for some $123.5 million to fund the executive direction and management of the Civil Works program. The request is $8.3 million above the Fiscal Year 1988 appropriation and is basically equivalent to the Fiscal Year 1987 funding level, except for several cost adjustments over which we have no control and a one-time mandated expense. Specifically, these adjustments include:

- o $0.8 million in personnel costs to cover anticipated employer contributions under the new Federal Employee Retirement System and the January 1988 pay raise,
- o $1.1 million increase in the Standard Level User Charge (SLUC) projected by the General Services Administration (GSA) for office building rent, and
- o $0.7 million for GSA mandated purchase of telephone equipment used in the Federal Telecommunications System (FTS).

With the Fiscal Year 1988 appropriation $13 million below our budget request some relief is needed in Fiscal Year 1989.

Absorbing the increased costs will result in a reduction in effort at a time when the enactment of the Water Resources Development Act of 1986 requires increased effort in the Office, Chief of Engineers and in Divisions to perform management and review, and to develop policy and guidance.

REVOLVING FUND

New budget authority in the amount of some $35 million is requested for the Plant Replacement and Improvement Program (PRIP) part of the Revolving Fund, for hardware acquisition under the continuing Corps of Engineers Automation Plan (CEAP) and to continue construction of a replacement dustpan dredge. Our PRIP program also includes a request for authority to finance improvements to our Missouri River Division laboratory. Improvements are needed to make the laboratory safe for the handling of toxic wastes in connection with our quality assurance testing for the Environmental Protection Agency (EPA) Superfund and Defense Restoration Fund programs. Improvement costs will be fully reimbursed out of Superfund and Defense Restoration Fund resources.

MOVE TO FORT BELVOIR

As you will recall, the Corps of Engineers headquarters is programmed to backfill space vacated by the U.S. Army Engineer School at Fort Belvoir in accordance with a 1985 decision by the Secretary of the Army. Since 1985, however, there have been a substantial number of stationing and other changes which have caused the Army to review the 1985 decision. Accordingly, we are considering some alternatives to the original plan which accommodate the changes while remaining within the intent and scope of the original decision. In addition to updating the original backfill analysis, two other options are being considered for the Corps headquarters. One would relocate the Corps headquarters into a reduced number of old buildings and one new building on the main post, and a second would move us into a new building at the Humphrey's Engineer Center, located at the northern corner of Fort Belvoir. In any case, a contingent of Civil Works staff will remain in or near downtown Washington to interface with Congress, the Office of Management and Budget, and other agencies and organizations.

A-76 PROGRAM

We are seeking the support of this subcommittee for increasing efficiency through the A-76 Program. A-76, with its built-in protections for current Federal employees, is a proven way for the Government to provide the same level of service at less cost, whether or not any work actually is contracted out. We are in compliance with Section 8128 of the 1988 Continuing Resolution.

Under the Competition in Government initiative of the Management Improvement Plan for Civil Works, the Corps anticipates conducting A-76 reviews of 1,400 full-time equivalent work years between now and the end of FY 1989. We have programmed some $3.4 million for these studies in FY 1989. Consistent with recent congressional directives and since the project positions or functions to be studied are funded under various appropriation accounts, the direct costs will be accumulated and seperately identified under the revolving fund. This will allow us to better track the funds and help assure that all study costs will be fully reimbursed by the other appropriations.

REGULATORY PROGRAM

The Assistant Secretary has already presented our position on our regulatory program. Our concern goes beyond reducing application review times and increasing permit fees. It concerns the responsiveness of our regulatory program and our service to the public.

We have worked hard to make the regulatory part of our mission a respected program by all those concerned with water resources development and land development. We have accomplished this by balancing developer, public and environmental interests. This has been very difficult to do, given the complexity of the program's objectives. We feel that we have done a very good job and I strongly believe that no other agency could match our record of performance and efficiency, given the constraints of manpower and dollars. If we are to maintain the viability of this national program we need the continued support of this subcommittee.

CONSTRUCTION PRODUCTIVITY ADVANCEMENT RESEARCH

In the area of construction research our laboratories have long taken a lead in developing better and more efficient ways of planning, designing, constructing, operating, maintaining, assessing, managing, evaluating and developing water resources projects.

The Assistant Secretary has brought to our attention, through his Construction Productivity Advancement Research proposal, that more needs to be done in both construction research and to ensure that the results of our research are in a form that is useful to the construction industry. We propose to do more in both of these areas.

CONCLUSION

The provisions in the Water Resources Development Act of 1986 provide opportunities for us to enhance even more our efficiency, productivity and predictability of the Civil Works Program. The Fiscal Year 1988 Bipartisan Budget Agreement further underscores the need to look for more ways to improve efficiency. We have and are taking steps to improve this efficiency.

The Administration and the Congress defined the new Federal role in water resources development. What we need to do now is to implement that role in a manner fully consistant with the joint venture approach with our sponsors as mandated by Public Law 99-662. Assistant Secretary Page is extremely well qualified, based upon a lifetime of experience in the engineering and construction business, to lead the way. I urge you to support him in any way you can.

I and members of the Corps family are extremely proud of our contributions to the development of this Nation's Water Resources. As I retire, I take great satisfaction in reflecting on the many magnificent projects with which I and the Corps family, both past and present, have been involved. But my greatest pride and satisfaction comes from the knowledge that I know I leave an organization that is prepared and eminently qualified to address the future water resource needs of this Nation.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS - CIVIL WORKS
SUMMARY OF PROGRAM AMOUNTS FOR FISCAL YEARS 1987, 1988, AND 1989
(Dollars in Thousands)

APPROPRIATION TITLE	1987 (Approp.)	1988 (Approp.)	1989 Budget Request
GENERAL INVESTIGATIONS	136,162	138,767	129,271
CONSTRUCTION, GENERAL			
General Funds	1,122,918	1,162,175	1,150,103
Inland Waterway Trust Funds	26,000	38,000	77,467
TOTAL Approriation	1,148,918	1,200,175	1,227,570
OPERATION AND MAINTENANCE, GENERAL			
General Funds	1,342,471	1,241,000	1,201,894
Special Recreation User Fee	12,500	12,000	15,000
Harbor Maintenance Trust Funds	35,000	147,000	156,000
TOTAL Approriation	1,389,971	1,400,000	1,372,894
GENERAL REGULATORY FUNCTIONS	n.a.	55,262	60,427
F.C., MISSISSIPPI RIVER & TRIB'S	310,797	317,704	334,297
GENERAL EXPENSES	118,232	115,200	123,465
F.C. & COASTAL EMERGENCIES	10,000	20,000	25,000
REVOLVING FUND	12,000	0	35,174
PERMANENT APPROPRIATIONS	10,885	9,000	9,000
TOTAL, FEDERAL BUDGET AUTHORITY	3,136,965	3,256,108	3,317,098
RIVERS AND HARBORS CONTRIBUTED FUNDS	114,943	233,000	241,000
TOTAL PROGRAM	3,251,908	3,489,108	3,558,098

INCREASE IN BUDGET PROGRAM

Senator JOHNSTON. Thank you very much, General Heiberg.

Gentlemen, the budget summit agreement, and most probably the Appropriations Committee allocations, do not correspond to the President's budget for this subcommittee. The President's budget represents a 10.2-percent increase for activities within energy and water, but the overall economic summit agreement provided for a 2-percent nominal increase.

Assuming we had to go by the 2-percent nominal increase, which is a real possibility when we get to what we call our 302(b) allocations under the Appropriations Committee pursuant to the budget law, do you have any advice to us as to where we might make cuts?

Mr. DOYLE. Mr. Chairman, while I cannot address the overall changes to the combined energy and water programs, it is my understanding that regarding the 302(b) allocation, the Corps requested a portion of that allocation is within the 2-percent increase called for by the summit agreement.

Senator JOHNSTON. We have 20 studies, 8 new planning starts, and 6 new construction starts, one of which carries a $1 billion federal cost. Do our future planning budgets allow for these kinds of commitments?

Mr. DOYLE. Yes, sir.

Senator JOHNSTON. I hope we can, and it will be my purpose to keep the Corps budget together to at least the 2 percent, but it is going to be very difficult this year to try to fund Superconducting-supercollider, and other new initiatives that are in this budget.

Some of those are funded with imaginary savings or, let's say, hoped for savings—like abolishing the Appalachian Regional Commission, which is an old battle, fought many times, and lost by the budget cutters every time.

It would be OK with me to cut the ARC since Appalachia does not lie within my state, but I know that there are some Senators to whom that program is very important. So I want you to be thinking for the future.

CORPS AIRPLANES

General Heiberg, you have taken a little flack here in the press lately on the use of the Corps' airplane. I wanted to give you an opportunity to respond to that criticism.

General HEIBERG. Thank you, sir. To me, the basic question is whether the Corps aircraft—there are three of them, two in the field and one at headquarters, an executive jet that has an overseas capability—help the Corps of Engineers in its responsibilities.

Mr. Page and Mr. Doyle can speak for themselves, but I didn't think that we had a chance to put our case forward in the recent testimony on the other side of the Hill.

I feel very strongly that the aircraft—one in Mississippi, one in Nebraska, are needed to help those division commanders cover the far reaches of their Corps responsibilities. The one here at Andrews is essential for me and the senior leaders of the Corps, and those that work with us, to carry out the worldwide missions of the Corps in a way that reflects the fact that we are, indeed, the free world's largest engineering organization.

We are global. We have permanent offices in 20 foreign countries and responsibilities in many more than that. The only way that we can oversee those responsibilities, both across the United States and across the globe, is by using modern transportation.

However, the flack that we have received would lead you to believe that we have a slick corporate jet; that is the term that was used. It is a very efficient airplane and we keep it safe and clean, that part is true. But, it is 20 years old. Furthermore, we go through the eye of a needle every time we fly that airplane to prove that we are making excellent use of the taxpayers' money in doing that.

NATIONAL AND INTERNATIONAL ROLES

I also received some flack for the fact that on occasion some of the Corps spouses, particularly my own wife, flew with me. I feel very, very strongly about this point. First, I have to go to the Chief of Staff of the Army to get approval for each one of the spouse flights, and I have to prove in each case that it is definitely in the national interest that she go along. Invariably, there is a mission for her to fill at the other end.

With the Corps family, both civilian and military personnel, scattered all over the globe. In fact, there are Corps people in every one of those 20 countries. And most of those Corps people have their families and children with them. That by itself is an important reason for the First Lady, if you will, of the Corps and certain of the other spouses to go along.

I, along with my compatriots, also meet ambassadors, occasionally heads of state, and senior government officials. We have to represent the United States, and it makes a lot of sense for many of those meetings to have both of us there.

The last point that I would make, sir, and then I am going to ask my colleagues, who also took some of this flack, to comment, is that in no instance have we asked for dollars for a spouse to travel. In each case where one of the spouses has been allowed by the Chief of Staff to go on one of the Corps planes, it has been at absolutely no expense to the government.

MANAGEMENT DECISION

Senator JOHNSTON. Do you want to comment on that, Mr. Page?

Mr. PAGE. Yes, sir, Mr. Chairman. As General Heiberg said, we had very little chance to respond—he had plenty of chances, but some of the others didn't. I think that General Heiberg and the Corps, in general, took some flack over a lot of issues which were not issues as far as I am concerned. In the report that was put together by the International Technical Expertise Corp. for our office and the Corps, we had the contractor look at those aircraft to figure out what the justification could be in dollars and cents.

Going back to my own experience, and I have been in the private sector all of my life—in my company we had our own aircraft. We never, in our company, and I know it applies to other companies, could justify an aircraft strictly on dollars and cents. You can't do it. It just can't be done. We knew that. It had to be a management call. And in this case the management call was that the utilization of those planes was important to carry out the mission of the Corps of Engineers worldwide. I supported that.

PRODUCTIVITY EVALUATION

In fact, the part of the report that took a great deal of flack involved the productivity factors which were used. What the productivity factors attempted to measure was: What was time worth to senior people, getting there and back safely, covering a lot of distances and points that we couldn't get to commercially, unless we went through an arduous exercise.

Those are intangible items, but they are productivity factors which have always been important to me. I would like to state, for the record, that I, personally, take responsibility for those productivity factors. They were dismissed by others but I don't think that they were given a fair evaluation.

In summary, we came to the conclusion, along with the Under Secretary, that the planes should be pooled with the rest of the Army planes. That has been done. In my opinion that is, without question, the best choice. We shall monitor their use over the next year to see how they are operated and whether such use bears out some of the productivity factors and savings we brought forth in that hearing, but which were so greatly criticized.

Senator JOHNSTON. Mr. Page, we in the government really have to march to different drums and adhere to different standards. We have to be especially careful in our use of government airplanes specially.

This subcommittee, of course, initially provided the Corps authority to purchase the aircraft. I must say, however, that I have not found abuse by the Corps of these airplanes. We would like to very carefully monitor that and be sure that that is so.

I did not find valid grounds for real criticism of the Corps in those articles, General Heiberg. I really think that it is important, upon occasion, for the First Lady of the Corps to go, not only because of the diplomatic and social considerations of your presence, but because it is important for the General's wife to interface with the Corps ladies of other officers who can report to her in a special way about living conditions, or education, or whatever the problems are.

Having said that, I do always bring in the word of caution that any thing can be overdone. In effect, what I am saying is that we do not find grounds in those articles for criticism of the use of the Corps planes, but we will continue to carefully monitor it, and I know you will continue to be—and that your successor will also be—especially careful about Corps planes because we do have to justify these on a more strict basis than the private sector would.

QUADULIN AND MARSHALL ISLANDS COASTAL ATLAS INVENTORY REPORT

Secretary Page, are you conversant with the requirements in last year's appropriation bills with reference to the coastal atlas and inventory report on Quadulin and Marshall Islands?

Mr. PAGE. No, sir.

Mr. DOYLE. Sir, I would be glad to respond to any questions on that.

Senator JOHNSTON. We provided money for those surveys to be done, and somewhere in the process they have not been done, and they are not being done. I don't know whether that is somebody in OMB or the Corps who is short-circuiting that process.

We are extremely concerned about that not only because we have put a lot of time and effort into that particular project, it is a very small one, I think there is only $250,000 involved, but it is the principle of the thing. We don't want to have to get to where we have to write everything into law.

We have an excellent relationship with the Corps and I hope we can put something in the report and expect that it be done.

Can we expect that to be done without fail?

Mr. DOYLE. Mr. Chairman, in this case and in a number of other cases, we found ourselves in a tough spot. We had more things to do, more tasks, if you will, to try and accomplish than we had dollars to accomplish them with.

Senator JOHNSTON. The past is the past. Can we expect it, without fail, to be done in the future knowing now that this small item is of high priority with us?

Mr. DOYLE. Mr. Chairman, we will have to consult with others and get you an answer for the record.

Senator JOHNSTON. I may have some more questions, but I would hope that we don't have a serious disagreement over such a small item. It is of high importance to us.

[The information follows:]

ALLOTMENT OF FUNDS

As a result of the concerns expressed regarding preparation of a coastal atlas and inventory report for the Republic of the Marshall Islands, we have reconsidered our decision and have allotted a total of $250,000 for this effort in fiscal year 1988, in accordance with the conference report guidance.

NANPIL HYDROPOWER PROJECT

Senator JOHNSTON. There is also another project on the Nanpil hydro project, which we would urge expeditiously to proceed with. Are you familiar with that?

Mr. DOYLE. Yes, sir; generally.

Senator JOHNSTON. Can we expect that that will be done?

Mr. DOYLE. We are currently in the process of considering your request to use some of the unexpended $8 million for operation, maintenance, and training in connection with that project. We will provide you with the results of that analysis as soon as we have it.

Senator JOHNSTON. That and the design of the diversion as well.

Mr. DOYLE. Right.

COLUMBIA RIVER FISH BYPASS FACILITIES

Senator JOHNSTON. Senator Hatfield.

Senator HATFIELD. Thank you, Mr. Chairman.

I commend you on launching these hearings of the subcommittee at this very early period. Hopefully, all the subcommittees will move ahead to provide the appropriators an opportunity to send 13 bills down to the White House in separate form.

Mr. Secretary, I welcome you to the committee, and also you, General, and your associates.

I have a number of questions on the subject of the fish bypasses on the Columbia River, which I would like to submit to you in writing for your early response, to see what action the committee may have to take.

I would only urge you, at this moment, to look at the Northwest Power Planning Council, which was created a number of years ago when Chairman Jackson was chairing the authorizing committee, and study the very unique role the Council has played in assessing the various and sundry uses and benefits of the federal installations on the Columbia River, including representing the interests of ratepayers, fisheries, power development, et cetera.

Notwithstanding participation in the region, there has been demonstrated evidence by the Corps here in D.C. to not fulfill language approved by the Congress and about $8.7 million relating to fishery bypass improvements, and this is what these questions are centered on.

MALHEUR LAKE, OREG.

At the moment, though, I would like to take up another project, a local project, relating to the Malheur Lake and the flooding that has occurred there now for a number of years.

In 1983, there was direction given to the Corps to make a comprehensive study of a way to mitigate flooding in Malheur and Harney Counties that included federal lands, of course, and federal interests. The Corps made such a study, and in that study, they indicated that the solution might involve construction of a 17-mile diversion canal costing as much as $20 to $40 million. They later revised that estimate downward. This committee listened attentively to the alternatives and decided that it was much too expensive of a project to fund. We had problems with local conservation groups, et cetera.

Also involved in this entire flooding problem is the inundating of the rail connection between Burns and Ontario in eastern Oregon, owned by Intermountain Gas Industries, Inc. Inundating of that railroad meant that the only linkage to the outside world for transportation of the timber and forestry products could not happen without added expense to the U.S. Forest Service.

In fact, it was estimated that the federal government's timber sale receipts would be $2 million less because of added expenses of truck hauling instead of transporting by rail.

One of the interesting alternatives was to raise the railroad, to raise it for a 6-mile distance, to make it operative, which meant that those timber contract sales could then be performed at the given price on the contract. That particular project would cost about $3 to $4 million, and subscribing from the very beginning in the cost-sharing philosophy, the state of Oregon was asked to put up a portion of that cost and they have committed themselves to a 25-percent share to raise that track.

We authorized that rail relocation project in a previous appropriation measure that was enacted. In the current fiscal year 1988, the CR had language in the report that would indicate that, within available funds, the Corps was directed to move ahead with that project, which would cost $3 million to the federal government, a far cry from the $25 or so million that could have been pursued, at least in appropriations, to deal with this basic problem.

RESPONSE TO CONGRESSIONAL REPORT LANGUAGE

The Corps has evidently shown reluctance, according to the Congressman from that district. The Corps has said that they must take that up for study, et cetera, which to us is but a delay, avoidance, a circumvention of the direction of this committee, in conference with the House committee, to tell the Corps what we expected the Corps to do on a specific instruction in the CR.

I understand, getting back some kind of information from the Corps, that you don't consider the report language as meaningful. I think you have, on many occasions in the past, taken that into consideration. We have always felt that that was a better way to communicate to the Corps.

I can assure the Corps that if we have to go to bill language in the coming fiscal year, we will go bill language, because we are going to have to have that done, and the sooner the better. Frankly, I am a little unhappy, and the Congressman is also, with the reluctance on the part of the Corps to respond to a directive by the Congress.

With that rather genteel approach, would you please respond.

Senator JOHNSTON. If the Senator would yield. We just had that conversation about report language and bill language.

Senator HATFIELD. Did you?

Senator JOHNSTON. Not with the same gentility, but with the same concern.

Senator HATFIELD. I thank the chairman for affirming my position.

STATUS OF CORPS STUDY

Mr. DOYLE. Senator, if I could respond to that please.

We are acting pursuant to the report language. A report on the project is currently pending before the Board of Engineers for Rivers and Harbors. Secretary Page has directed the Board to proceed and give the report its traditional technical review. The next time the Board meets, I believe, is in the next 3 or 4 weeks, and then the report will go forward.

POLICY AND OWNERSHIP QUESTIONS

In the meantime, a question has arisen as to whether or not a standing policy relating to projects which would benefit only one beneficiary may serve as a bar to the project. Secretary Page has tasked an investigation to be done of that in the last couple of weeks. That should be completed shortly, and with it we will have the information to be able to make a determination of how quickly to proceed and in what fashion can we proceed.

Another one of the questions that had us going slowly was that there was some question about the future of that spur—whether there would be a purchaser of the railroad line that is in question. That was recently resolved, as I understand it, and in addition some commitments were obtained that make it easier for us to go forward again.

Senator **Hatfield.** I will be happy to supply you with a document from the Inter-Mountain Gas Industries on a commitment of 5 years at least on the operation of that particular rail. Also, the county has undertaken an obligation, and the state has a program on rehabilitation or renewing rail lines that have been abandoned or in the process of being abandoned.

You have, in other words, state government and local government already taking on obligations, and also the operating entity, Inter-Mountain Gas Industries.

I would hope that you would also, in reviewing that particular policy that you raise on single beneficiaries, go back to the authorizing language and study that as a part of the law.

INVESTMENT PAYOUT AND IMPACT

Then, I would like to indicate to you that not only is this a timber operation that is established by the federal government on federal forest lands, the $2 million added transportation cost will accrue back to the government, and we could pay that off. It would be a payout in 2 years. You have, therefore, a neutral budgetary impact over that period of time.

This community is both a timber-producing community and an agricultural-producing community. Therefore, you are going to have an impact upon far more than a single company that has a timber contract. There are multiple companies under multiple contracts for timber harvest, but there is also the entire future of the community, really, that is riding on this particular ability to provide transportation out of a very rural area. When you get to Burns, you have gotten to almost the end of the road, so to speak, and that is no denigration. The people who brave that frontier are very good supporters.

Mr. **Doyle.** It is also my understanding, sir, that the new purchaser of the railroad has really taken an unusual step and offered the federal government a security interest in the rail line in the event that sometime in the future there is need to abandon it. That purchaser, if my information is correct, has been willing to provide some extra assurance that the federal dollars will be protected.

Senator HATFIELD. Whatever new obstacles you want to raise, I think we can meet them.

Mr. DOYLE. I have no doubt.

PROCESSING OF REPORT

General HEIBERG. Sir, I have made the commitment to make sure that the Corps' report, to the best of our ability, after it goes through my Board that reports to me, is to the Assistant Secretary's Office by early summer.

I will go back, after this conversation, and make sure that your staff knows that it is or it isn't on the docket of my Board's next meeting, which I believe is in the next 3 weeks.

Senator HATFIELD. Thank you, General. I appreciate that.

Again, General, we are talking about $3 million to solve a problem that when, if we had a project approach to it, who knows how much a canal of that kind, 17 miles long, would cost. To me, to solve this problem at this bargain basement price is, I think, a very wise move to take that off your back. I would imagine that it would be worth that much in grey hairs.

ADDITIONAL PREPARED QUESTIONS SUBMITTED FOR THE RECORD

Thank you, Mr. Chairman. I have additional questions which I would like to have answered for the record.

Senator JOHNSTON. Thank you, Senator Hatfield.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR HATFIELD

COLUMBIA RIVER BYPASS

Senator HATFIELD: For the past two years Congress has strongly supported efforts to protect juvenile salmon and steelhead from the mortality imposed by Corps mainstream dams on the lower Columbia and Snake Rivers. A total of $8.7 million for five improvement projects was approved in FY88 along with a request that this work be given a higher priority in FY 1989. Given that the Corps has been deeply involved with the regional interest groups in this plan, and understanding also that the entire project costs are paid for from regional power rates, recognizing also that the other two federally chartered entities; the Bonneville Power Administration and the Northwest Power Planning Council; are both deeply committed to this plan, why is not the work proceeding for FY 1988?

General HEIBERG: Sir, we are and have been proceeding with some elements of the Juvenile Fish Bypass program. In FY 1988 we are using budgeted funds to continue studies and prototype development of improved bypass measures at the Bonneville Second Powerhouse. Also, we have recently completed an interim gate raise to improve guidance efficiency at both Lower Granite and Little Goose dams. Further, plans and specifications have been completed for two new fish hauling barges. Additional funds up to $1 million from the $8.7 million provided in the Conference Report accompanying, 1988 CRA will be allotted to develop an agreed upon plan which addresses long term issues. Moreover, $3 million is being alloted to purchase two barges to facilitate transport of juveniles downstream. Allotment of funds for other discrete activities such as the traveling screens is dependent upon development of the long term program.

Senator HATFIELD: And why has the Corps chosen to develop an alternative plan of its own outside the regional planning process? Is it possible to proceed with at least some of the most highly justified actions while awaiting review from OMB of the Corps alternative plan?

General HEIBERG: The Corps is committed to participate in a program to mitigate juvenile fish losses. This plan, when developed, will be fully coordinated with all concerned agencies. In the meantime, we are continuing to proceed with measures such as those I have just addressed.

SENATOR HATFIELD: Regarding the Corps alternative fish bypass plan currently under review at Headquarters and by OMB, when do you expect that plan to be approved?

GENERAL HEIBERG: The Corps plan, when developed in the context of an overall program with agreed upon goals and objectives will be presented to the Assistant Secretary of the Army and OMB for review and approval. I can not give a timetable at this time.

SENATOR HATFIELD: Has the plan been shared with regional interest groups such as the Power Council and the BPA?

GENERAL HEIBERG: With funds to be provided from the $8.7 million, we will develop an overall plan to be coordinated with the Power Council and BPA and other regional interests.

SENATOR HATFIELD: In what regard is the alternative plan similar to, and to what extent does it vary from, the plan proposed by the Power Council?

GENERAL HEIBERG: Sir, we have not yet developed a plan or program. The report provided to me incrementally analyzes measures that are deemed to be economically justified. I want to assure that the program that the Corps commits itself to clearly identifies system wide goals and objectives that are understood and agreed to by concerned interests and specifically the Power Council.

SENATOR HATFIELD: Are the power, water and fish assumptions included in the Corps alternative plan consistent with the assumptions used to develop the Power Council's Plan, and if not, why?

GENERAL HEIBERG: Sir, the program that we will develop will be based upon agreed upon assumptions. The Corps will work on these issues to assure a common understanding and hopefully a consensus agreement with the Power Council.

SENATOR HATFIELD: Regarding the precise fish bypass recommendations of the Corps alternative plan, please identify by project and activity those bypass improvements which are proposed by the Power Council but which are not proposed by the Corps.

GENERAL HEIBERG: Sir, until we develop our plan, it would be premature to make such a comparison.

SENATOR HATFIELD: And similarly, please identify those bypass improvements which are proposed by the Council but which may be modified by the Corps alternative plan.

GENERAL HEIBERG: I believe there is agreement on transportation measures that the Corps is currently pursuing. I would leave further discussion of the details of our proposals until we have developed our overall plan.

SENATOR HATFIELD: In FY88 you expressed a capability to acquire new barges for fish transport. Accordingly, funds for this item were added by Congress. In view of your approved capability, why have not funds been allocated to the Corps so this important work can proceed?

GENERAL HEIBERG: As plans and specifications for the new barges are now ready, we expect to begin procurement in the near future.

ELK CREEK

SENATOR HATFIELD: According to the chronology provided in your budget justification, the very first EIS on the Elk Creek Dam project was completed in September 1971. That was followed by a supplemental looking into water quality (1980); then an environmental assessment addressing design changes in the dam was also conducted (1983); and two Records of Decisions were filed with EPA, first in 1982 then again in 1986. The point being, that the Corps has done a considerable amount of environmental analysis on this project dating back to the early 1970's. Why after all this time and effort did parties seek at this particular time to raise questions with the Ninth Circuit Court of Appeals regarding the environmental sufficiency of the Corps work? Why weren't these questions brought forward with the first EIS in 1971? Or for that matter, why were't these questions raised at any time prior to the actual construction of the dam?

GENERAL HEIBERG: Several challenges were raised prior to construction. Those issues were addressed based on an EIS we considered adequate. As you know, the Administration had long opposed starting construction of this project on economic grounds. With this position and without a Congressional mandate and appropriations to begin construction, project opponents apparently had little incentive to mount a serious campaign to prevent construction. However, upon Congressional direction to begin construction, the Oregon Natural Resources Council began the legal process that eventually resulted in the injunction. We note that this suit was initiated prior to construction. We did not begin construction until the District Court decided in our favor.

SENATOR HATFIELD: Has the Corps and the Justice Department made a decision regarding a further appeal to the Supreme Court? If not, when will that decision be made?

GENERAL HEIBERG: Both the Corps and the Department of Justice have recommended taking the case to the Supreme Court. The Court has set March 30, 1988 as the date by which the Government must file.

SENATOR HATFIELD: What long term implications do you think this decision has on other Corps, or any other federal construction project? Could for example, Congress appropriate money for construction of a super-conductor super-collider only to have that MULTI-BILLION project halted half way through construction because of an environmental challenge?

GENERAL HEIBERG: We see nothing that would prevent similar problems with other projects.

SENATOR HATFIELD: My basic point is this...I would not want to deny anyone the right to challenge a federal agency's thoroughness in completing the appropriate environmental justification, but I see a growing trend with the Elk Creek Dam project, with federal timber sales that are already awarded and ready for harvesting; and other cases, where those legal challenges are being brought into the process so late in the game that rather severe consequences result with which Congress should be concerned. Would you like to comment on that assessment? For example, could you tell us how much the Corps expects to spend completing the additional environmental work? How much money was "lost" terminating the contract of the construction company? And how much additional money it will cost to complete the dam once construction is allowed to proceed?

GENERAL HEIBERG: Yes, sir. The cost for additional environmental studies alone will be about $700,000 over two and one-half years. Negotiations for terminating the construction contract are underway so we do not have final contract costs yet. However, we think some $13 million will be required for termination and would not buy productive work on the project. Depending on the scenario, the cost increase to complete the project will range from $20 to $40 million and most of this will be associated with completing the dam itself.

SENATOR HATFIELD: Could you outline for the Committee, perhaps in detailed information for the record what actions this committee might take to assist the Corps in completing the necessary environmental studies, but perhaps concurrently completing other measures that would save time and money once construction is allowed to proceed? Simply put, what could we be doing to expedite resumption of construction and minimize the cost increase following completion of the Supplemental EIS?

GENERAL HEIBERG: We appreciate the Committee's concern, but at this point do not see any special actions the Committee would need to take. Our budget request reflects the plan that best addresses the problems raised by the injunction, in our judgement. Our focus is to complete the environmental studies as soon as possible while maintaining responsible stewardship of the partially completed project. At this time we have not scheduled plans and specifications for a new contract for completion of the dam, pending an outcome of the environmental studies. These studies potentially could change the dam from the way it was originally designed. However, if plans and specifications were completed concurrently with environmental studies, and were ultimately consistent with the results of the Supplemental EIS, the dam could be completed about one year sooner, with a moderate cost savings.

SENATOR HATFIELD: As well, I would be interested in knowing, if Congress directed you to resume construction in FY88 under your original contract, what would the cost increase be above your original estimates?

GENERAL HEIBERG: If we could resume construction of the dam under the current contract, the cost increase would be between $10 and $15 million. However, the termination process is rapidly proceeding and this ability may not exist after June 1988.

SENATOR HATFIELD: And what cost savings might be realized by proceeding with construction compared to waiting until completion of the Supplemental EIS?

GENERAL HEIBERG: As previously stated, the $20-$40 million cost increase could be reduced to $10-15 million if we could utilize the existing contract. After we lose this ability, the cost savings for early resumption of construciton are mostly lost.

BONNEVILLE LOCK AND DAM

SENATOR HATFIELD: The current Federal cost estimate for completed construction has increased from $200,000,000 to $212,000,000 according to the budget justification. Please explain the (+$11.345M) Post Contract Award and Other Estimating Adjustments which account for the bulk of this cost adjustment.

GENERAL HEIBERG: This cost increase of $11,345,000 is primarily due to revised estimates and high bids for lock excavation (+$6,528,000), differing site conditions and other changes on the railroad relocation contract (+$1,222,000), a reanalysis of requirements for engineering and design and supervision and administration; (+$5,100,000) partially offset by value engineering and miscellaneous savings (-$1,505,000).

SENATOR HATFIELD: Does the FY89 construction request of $42M include these new cost increases? If not, at what point in construction wil those costs be reflected?

GENERAL HEIBERG: No, sir. These cost increases are primarily for the work that is being completed prior to FY 1989 with available funds.

SENATOR HATFIELD: Aside from the cost increases, is the project on schedule to meet its 1992 completion date? If not, what is the estimated completion date?

GENERAL HEIBERG: Yes, sir. The project is currently on schedule.

SENATOR HATFIELD: Could the proposed completion date be accelerated if Federal funds were increased in FY89? If so, what specific construction activities would be proposed that are not now scheduled? How much additional money above the FY89 request would be required to conduct those activities? How much time would be saved as a result? And would any "inflation savings" be realized by stepping up the construction timetable?

GENERAL HEIBERG: No, sir. The schedule for this project is already tight and adequately funded with our FY 1989 budget request.

BONNEVILLE LOCK AND DAM

SENATOR HATFIELD: Heretofore, excavated materials from the dam construction (spoils) that are determined to be surplus to the project, are disposed of by the contractor, who may place them in an approved disposal area, or who may sell the spoils to a third party developer. Regarding the spoils from the Bonneville project, several parties have expressed interest in acquiring the surplus material including a consortium of five mid-Columbia Port Districts who are seeking "priority" in disposal of the spoils and who may be seeking to be "given at no charge" the surplus materials.

What is the status of the negotiations between all interested parties who are seeking access to the spoils?

GENERAL HEIBERG: Sir, our Portland District Office has met several times during the past two months with the upstream mid-Columbia Port Authorities. They understand that it would not be in the best interest of the Federal government to require the contractor to dispose of spoils on specific sites unless it fulfilled a project purpose and was cost effective. We have determined that upstream disposal of material at these sites would not be in the Federal interest or cost effective.

SENATOR HATFIELD: Are public ports statutorily, or legally, barred from acquiring the spoils?

GENERAL HEIBERG: No Sir. However, we understand that a local private power company, the Portland General Electric Company at Hayden Island, is willing to pay for the spoils. This would appear to put the Ports in competition for the material.

SENATOR HATFIELD: Is there a precedent in other Corps projects for giving a public entity "priority consideration" for acquiring of surplus materials? And if so, in what form was the "priority" given (eg. donated; waiver of fees, 10% bid preference, etc.).

GENERAL HEIBERG: Sir, we are not aware of any precedent in other Corps projects on the issue of public entity priority consideration.

SENATOR HATFIELD: What other similar surplus material might be available from other Corps projects and activities that could be made available for local land development in the Mid-Columbia area?

GENERAL HEIBERG: Sir, we know of no significant surpluses from other Corps projects that could be made available to the ports in their area.

COOS BAY
Deep Draft Navigation Study

SENATOR HATFIELD: $250,000 in FY88 funds are being used to initiate the reconnaissance phase of a feasibility study for channel deepening at Coos Bay. Is the reconnaissance work "on target" for completion in May 1988? Please summarize the results of the work conducted thus far?

GENERAL HEIBERG: The reconnaissance phase is on schedule for completion in May 1988. The reconnaissance report, completed in December 1987, identified three alternative plans as having a favorable benefit-to-cost ratio, and recommended a feasibility phase study. Preparation of the scope of study for the Feasibility Cost Sharing Agreement is currently underway. We expect to negotiate the Agreement with the potential sponsor, International Port of Coos Bay, beginning March 1988.

SENATOR HATFIELD: Follow-on feasibility work of about $476,000 is currently estimated, of which $238,000 is the 50 percent federal share. However, only $80,000 is proposed in the FY 89 budget request. Are FY 89 proposed funding levels sufficient to meet the scheduled August 1990 completion date for the feasibility study?

GENERAL HEIBERG: Yes, sir. At this point our budget request is considered to be adequate. However, we will soon be meeting with the Port to negotiate the Feasibility Cost Sharing Agreement for the feasibility phase of the study. This will help us update our funding requirement.

SENATOR HATFIELD: What are the estimated follow-on federal requirements in FY90 for the study?

GENERAL HEIBERG: Our additional Federal requirement to complete the study after FY 1989, now scheduled for August 1990, is currently estimated at $58,000. Of course, the President has not yet established his budget request for FY 1990.

SENATOR HATFIELD: What is the status of the $238,000 local match and what portion of that might be in-kind services?

GENERAL HEIBERG: On 18 February 1988, Governor Goldschmidt approved provision of $240,000 in State funds to the International Port of Coos Bay. These funds are intended to be used for local cost sharing on the feasibility study. At this time we understand the Port does not intend to provide in-kind services.

Breach In The North Jetty

SENATOR HATFIELD: When precisely in the Spring of 1987 did the breach in the North Jetty occur?

GENERAL HEIBERG: Actually, the breach was first noticed around January 1987.

SENATOR HATFIELD: How long after the breach did the build-up of silt, sediment and other debris begin to encroach on the navigation channel and marina complex?

GENERAL HEIBERG: There is no significant increase in channel shoaling that has been detected since the breach was first observed. The breach area of the jetty is still functioning as a barrier to littoral drift.

SENATOR HATFIELD: Procedurally, what is the first response or action to be taken by the Corps when a breach like this occurs, and at what time did the Corps take such action in the instance of the Coos Bay breach?

GENERAL HEIBERG: Generally, our first response to a breach in a jetty is to conduct a Reconnaissance Report to determine whether repairs are needed. The Corps began this report in March, 1987.

SENATOR HATFIELD: It is my understanding that design work has been initiated to repair the breach but that such efforts have not yet been completed. When did such design work actually begin? When will they be completed? What is the estimated expense to the Corps incurred to date on such work? And what will likely be the total costs of the design portion of this repair?

GENERAL HEIBERG: The design for the Coos Bay North Jetty breach repair was initiated in February, 1988 and should be completed in June, 1988 at an estimated cost of $175,000. The Reconnaissance Report cost $15,000.

SENATOR HATFIELD: How soon after the design work can actual repairs begin on the North Jetty breach? Per the proposed completion date of the design work (see above), when will the Corps begin to make actual repairs in the jetty and how long will it take to complete the work?

GENERAL HEIBERG: Repairs to the breach could begin in the May - June timeframe of 1989, assuming the availability of funds, following completion of contract documents scheduled for February 1989. Rock placement could be completed by end of FY 1989 with site restoration completed in the first quarter of FY 1990.

SENATOR HATFIELD: What interim control measures might be taken, if any, to prevent further build-up of silt and sediment until permanent repairs can be made?

GENERAL HEIBERG: At this point, we do not anticipate the need for interim control measures to prevent shoaling.

SENATOR HATFIELD: What interim repairs to the jetty might be taken, if any, to prevent further damage to the jetty itself?

GENERAL HEIBERG: So far, we believe that interim repairs to the jetty are neither feasible nor necessary.

SENATOR HATFIELD: If no interim repairs to the jetty are necessary to prevent a more serious breach, what evidence does the Corps have that further deterioration of the jetty will, in fact, not occur? Do these assurances of no further deterioration include a high degree of confidence that the navigation channel will not be closed?

GENERAL HEIBERG: Based on our judgement of this situation, we assume some limited amount of deterioration will occur which is a function of severity of future storms. However, even with severe deterioration, we do not expect the channel would be seriously jeopardized before permanent repairs could be completed.

SENATOR HATFIELD: What are the estimated costs to repair the jetty? Are funds available from FY88 balances or will appropriated funds be required above the request in FY89?

GENERAL HEIBERG: At this early stage of design, an accurate cost estimate is not available. Funds are not available in FY 1988, or in the FY 1989 budget for the repair contract. Our FY 1989 capability for this work is under review and will be provided as soon as possible.

OREGON COAST, MISCELLANEOUS
Astoria

SENATOR HATFIELD: Congress added $1.75 million for the Tongue Point project in FY88. What is the status of this project, and what funds if any are provided for in FY89?

GENERAL HEIBERG: A Section 107 reconnaissance report is scheduled to be completed in March 1988. Preliminary findings indicated there is Federal interest in providing deep-draft navigation improvements, including an entrance channel and turning basin, which justifies proceeding into the feasibility phase. A draft Feasibility Cost-Sharing Agreement is currently being prepared. Feasibility phase study is expected to begin later this summer after the reconnaissance report and Feasibility Cost-Sharing Agreement are approved. Specific funds for the feasibility phase and construction have not yet been designated or requested for FY 89.

SENATOR HATFIELD: When would you expect to be able to construct the Tongue Point project, and what do you estimate would be the total construction costs?

GENERAL HEIBERG: Project construction could occur in the fall of 1989, subject to project approval and funding. Construction dredging should be limited to the mid-August to mid-November time frame for environmental reasons. The total construction cost is presently estimated to be about $4,200,000.

SENATOR HATFIELD: If planning and/or construction were to proceed in FY89, what level of funding would be required to appropriately accelerate the schedule to its earliest possible completion date?

GENERAL HEIBERG: Because of the August-November dredging window, the earliest possible construction start for the Tongue Point project would be the fall of 1989. Our ability to meet this early construction date is a function of the time required to complete the feasibility phase, develop a Local Cooperation Agreement for construction, prepare plans and specifications and advertise and award construction. Since it is planned to accelerate these activities as much as possible, additional funding would not be a factor.

SENATOR HATFIELD: Design deficiencies continue to plague the East End boat basin in Astoria, and some investigations have taken place regarding possible corrections to that problem. Please provide a discussion of the major issues confronting the water surge problem at that boat basin; a status report on any studies or investigations; and a timetable to eventual resolution of the problem.

GENERAL HEIBERG: The boat basin is subject to surging waves and other adverse conditions due to the configurations of the east and west entrances formed by the existing sheetpile wingwalls which are deteriorated. A study completed by the Portland District Engineer in June 1986 called for replacing the east and west entrance wingwalls with rubblemound breakwaters at an estimated cost of $1.7 million. However, the study did not consider the cost of replacing the main breakwater (approximately $10 million), nor the other deficiencies noted above. On 19 February 1988, a meeting was held with interested local officials concerning a possible Section 107 Continuing Authority study to evaluate alternative harbor plans. An initial appraisal study could be initiated following receipt of a study request from the Port of Astoria.

Yaquina Bay and Harbor

SENATOR HATFIELD: Congress added $4.0 million for this project in FY88 to repair the north jetty. What is the status of that repair work; what is the estimated cost for the entire project, and when do you expect to have it completed?

GENERAL HEIBERG: Award of the contract for repairs to the Yaquina Bay North Jetty is expected in early March 1988. The estimated cost of the entire repair is $6.73 million. Rock placement should be completed this fiscal year.

OREGON COAST, MISCELLANEOUS

Umpqua River

SENATOR HATFIELD: Please describe the shoreline erosion that is occurring at three different locations along this project; how do you propose to accomplish the necessary work, and; what is the current status of actual work at each of the three locations?

GENERAL HEIBERG:

The Portland District, Corps of Engineers, has shoreline erosion projects at three different locations in the Umpqua River estuary under different authorities. The project areas are just upstream of the training jetty on the south shoreline.

A portion of the work is the repair of existing shoreline stabilization works constructed by the Corps in FY 1954, following completion of the training jetty. This repair has been performed using Operations and Maintenance general funds since the work area is part of the Federal Navigation Project. Work has been completed along approximately 1,370 linear feet of rock revetment to help protect the remainder of the shoreline in this area. The contract amount is $397,000 and work is completed.

A Section 14 (Flood Control Act of 1946) study has been completed to address shoreline protection of a Douglas County road which provides a direct route to recreational beach areas and some limited residences west of Winchester Bay. This study report is presently under review at the Washington, D.C. level. A project is proposed which would provide rock revetment protection of approximately 1,470 linear feet of roadway. Estimated cost for the work is $480,000. Local interests would be responsible for 25 percent of this cost. A Local Cooperation Agreement has been negotiated in draft form with Douglas County, the local sponsor.

A study under the authority of Section 111 of the Rivers and Harbors Act of 1968 is being conducted to address the feasibility of measures to prevent shoreline damages near the boat basin attributable to the Federal navigation project. The study is considering providing protection of approximately 2,750 linear feet of the spit which forms the westerly boundary of the Salmon Harbor small-boat moorage facility. Cost of the protective works are currently estimated to be $939,000. Report is scheduled for completion in the summer of 1988.

Coquille River

SENATOR HATFIELD: What is the status of your ongoing study to deepen the Coquille River channel, and; when do you expect to complete the study?

GENERAL HEIBERG: The Portland District Engineer has submitted his final Detailed Project Report, along with a draft Local Cooperation Agreement, to the North Pacific Division Engineer for his review and approval. The report recommends a plan of improvement to deepen the Federal entrance channel to 18 feet MLLW at a cost of about $405,000. The Port of Bandon has requested financial assistance from the State of Oregon to help them meet their non-Federal cost sharing requirement for project construction.

Rogue River Harbor At Gold Beach

SENATOR HATFIELD: Why did your funding needs for this project decrease from $412,900 in FY88 to only $44,000 in FY89, what is your FY89 capability for this project and how would it be used, and, please describe how the experimental timber pile groins are functioning on this project?

GENERAL HEIBERG: The decrease in the FY 1989 budget as compared to FY 1988 primarily reflects budget priorities for FY 1989. FY 1989 capabilities are under review and will be provided to the Committee as soon as possible.

The experimental timber pile dike groins are functioning fairly well. Indications are that the groins are effective in keeping material out of the entrance channel to the boat basin. Experience has been that we require a repair contract approximately every 2 years. The bulk of the effort is required on the outer pile dike of the three pile dikes installed. The two interior dikes have been holding up very well. An overall assessment of the groin system will be made following completion of the 5-year monitoring program in 1989.

Dredges YAQUINA and ESSAYONS

SENATOR HATFIELD: How are the dredges performing, how many yards of material were removed by each in FY87 and at what cost, and; how does this quantity and cost compare to the work performed by contract hopper dredge in FY 87?

GENERAL HEIBERG: Corps of Engineers Minimum Fleet Dredges ESSAYONS and YAQUINA are performing exceptionally well. The quantity & cost comparison between government and contractor plant for FY 87 follows:

Gov't Plant	Quantity (cy)	Cost ($)
ESSAYONS	8,607,200	12,372,500
YAQUINA	1,639,500	5,381,500
Contractor Plant	4,636,000	11,317,000

Mt. St. Helens

SENATOR HATFIELD: What is the status of the sediment retention structure; has it been able to successfully trap sediment; why is the FY88 program reduced by $11 million, and; will those funds be needed in FY89?

GENERAL HEIBERG: The Mt. St. Helens Sediment Control project is on schedule toward our September 1989 completion date. The Sediment Retention Structure began trapping sediment in the fall of 1987. Our FY 1988 funding requirement is reduced because the sediment infill in the Cowlitz River has been less to date than previously estimated. Therefore, the $11 million reduction in FY 1988 is not expected increase our FY 1989 requirement.

Basin Bank Protection

SENATOR HATFIELD: Both the Lower Columbia and Willamette River Basin Bank Protection projects were funded at about $1.1 million but are being reduced to just $130,000 in FY88 and $200,000 and $160,000 respectively, in FY89. Why are these two programs being reduced in FY88; will those funds be needed in FY89; under what circumstances could work proceed on an expedited basis in FY89?

GENERAL HEIBERG: These projects have been reduced because, at this time, we have been unable to obtain cost sharing agreements with any local sponsors. FY 1988 and FY 1989 funds will be used to evaluate sites and coordinate with potential cost sharing partners. Proceeding with construction will be dependent upon finding sponsors for economically justified locations.

Port Orford

SENATOR HATFIELD: Congress appropriated $257,000 in FY88 to maintain the channel for this project. What is the status of channel maintenance; why are funds not requested in FY89; what is your FY89 capability for this project?

GENERAL HEIBERG: We have an "on-call" contract to keep Port Orford dredged when required. The contractor has dredged sufficiently to take care of expected additional requirements is FY 1988. The FY 1989 capability is under review and will be furnished to the Committee as soon as possible.

ST. PAUL ISLAND HAROBR, ALASKA

Senator HATFIELD: Congress appropriated $3.0 million to begin construction of the St. Paul project in FY 1988. What is the status of this project; how will the $7.0 million requested in FY89 be utilized; and what is the status of the Local Cost-Sharing Agreement for this project?

General HEIBERG: FY 1988 funds have been allotted to continue the Section 204(e) evaluation process, which could allow the local sponsor to proceed with construction and later be reimbursed for the Federal share of cost incurred. Further allotment of FY 1988 funds will be addressed after review and approval of the Section 204(e) report. The current project schedule assumes completion of the General Design Memorandum and the local cooperation agreement in April 1988. A final local cooperation agreement would be signed after approval of a Section 204(e) report. The City of St. Paul proposes to begin construction of the harbor improvement in May 1988. If the 204(e) report is approved and other normal requirements are met, FY 1989 funds would be used for reimbursement to the City of St. Paul.

CLATSKANIE RIVER DREDGING

Senator HATFIELD: The Columbia Soil and Water Conservation district recently has identified dredging of the Claskanie River a high priority project. What has been the extent of the Corps involvement with local groups in addressing this problem; what is the Corps most recent assessment of the need to dredge the Clatskanie, has the Corps studied whether the continuing sediment in the river channel is directly or indirectly related to fallout from Mt. St. Helens, and; what would be the total dredging costs in FY 1989 if the Corps were to proceed?

General HEIBERG: The Corps reviewed the Clatskanie River Project in FY 1985 and concluded flood control measures were not feasible as most of the flooding was occurring due to backwaters from the Columbia River. The City recently expressed interest in having the dredging done under the normal O&M program for recreational craft using the river. The Corps response was that dredging is authorized for commercial navigation, not recreation, and it is not being maintained due to a lack of need. The Corps has conducted no particular studies or investigations regarding impacts on the Clatskanie River resulting from the Mt. St. Helens eruption.

CLIFTON, ARIZ., FLOOD CONTROL PROJECT

Senator JOHNSTON. Senator DeConcini.

Senator DECONCINI. Mr. Chairman, thank you very much.

Mr. Secretary, we welcome you here. I am pleased to have a chance to hear your testimony.

General Heiberg and General Hatch, I do want to thank the Corps very much for having Colonel Ono available to the Clifton community at a recent presentation of the work there. It was very helpful and done in a most professional way. We appreciate the work that the Corps and the staff have done in this area.

I was also pleased to see $450,000 included in the fiscal year 1989 budget to continue the preconstruction engineering and design of the Clifton flood control project. Can you tell me, General, when the Corps will be able to start the actual construction of the flood control levee?

General HEIBERG. March 1990 is when our preconstruction engineering and design will be completed. Construction probably could be initiated in the fourth quarter.

Senator DECONCINI. Is that based on the projects that you have, or on how long you think the preconstruction will take, with the geological testing that you are going to start this year?

General HEIBERG. That estimate is based on the report that we have from our folks in the field; that report indicates that they can meet that schedule.

Senator DECONCINI. I see.

Mr. DOYLE. It will take that long, Senator, to do the preconstruction engineering and design.

Senator DECONCINI. Has that preconstruction engineering started?

General HEIBERG. I don't believe the actual preconstruction has started yet, sir. We are in the final review of the feasibility report.

Mr. DOYLE. But the money has been made available.

General HEIBERG. We have allocated the money.

Senator DECONCINI. You will do it this year?

General HEIBERG. Yes.

Senator DECONCINI. I understand you are presently reviewing the economic feasibility of the relocation portion of the Clifton project. When do you expect to have those studies completed, and give us some indication as to whether or not the relocation is feasible?

General HEIBERG. Sir, if I may, I would like to have General Hatch provide that.

General HATCH. The feasibility report was completed and approved by the Board of Engineers for Rivers and Harbors in June 1987. The report recommended a project that includes levee construction and relocation of existing residents in the flood plain, both of which are economically feasible. However, additional information regarding the economic analyses of the relocation element was requested before final processing of the report. The results of the reanalysis are currently under review and we expect to have the matter resolved in April 1988.

Senator DECONCINI. If the relocation is feasible, we would like to undertake the project as one including the flood control levee. I understand additional authorization will be necessary. Can you provide for the record the language necessary to authorize both the relocation and the flood control levee for Clifton?

General HATCH. We will provide language for the proposed combination relocation and flood control levee for the record.

[The information follows:]

FLOOD CONTROL

Authorization of construction—The project for flood control for Clifton, Arizona, is adopted and authorized to be prosecuted by the Secretary substantially in accordance with the plans and subject to the conditions recommended in the report of the Chief of Engineers, dated ______________. The comprehensive project shall include both relocation of flood-plain structures and construction of a flood control levee at a total cost of $11, 670,000, with an estimated first Federal cost of $8,530,000 and an estimated non-Federal first cost of $3,140,000. Cost sharing will be in accordance with the provisions of the Water Resources Development Act of 1986.

ART IN PROJECT DESIGN

Senator DECONCINI. As you know, the town of Clifton and the state of Arizona are interested in retaining two artists to participate in the design of this flood control levee. Colonel Ono pointed out a few projects where you have apparently done that before, and they were quite impressive.

Is the Corps willing to allow this to be done in this particular project? Do you have a policy on that?

General HEIBERG. We have a policy of doing what is smart, sir. We have, indeed, used artists in the past. In fact, the No. 1 award winner for the last 2-year competition, Morgan City flood control project, has a great deal of art integrated into it. We did that at virtually no cost, and it does a world to what the project looks like.

I will make sure that our Los Angeles District folks get a strong direction to make that available.

Senator DECONCINI. I see that there is approximately $61,000 in the Corps planning document for esthetic treatment. Would this be part of the artist participation?

General HEIBERG. Yes, sir.

NAVAJO RESERVATION FLOOD CONTROL STUDY

Senator DECONCINI. Mr. Secretary, I note that $400,000 has been requested to continue survey work for the Navajo Reservation-wide flood control study. I commend the Corps for moving along on this important project.

As you know, the Water Resource Development Act of 1986 included a provision directing the Corps to give consideration to economic benefits for Indian tribes that may be derived from the construction of a water project. Does the Corps intend to include these regional benefits in its economic analysis on the reservation?

Mr. PAGE. I believe that the report is scheduled to be submitted to our division next month. Some of the benefits derived from the construction will be classified as tribal economic development benefits.

Senator DECONCINI. Thank you.

ABILITY TO PAY

I am sure you are aware of the trust responsibilities that we, as a government, have with our Native Americans. Obviously, economics being what they are on most reservations, the Navajo Tribe will not be in the best position to share in the cost of either the feasibility study or the project construction.

Does the Corps intend to waive the cost-sharing requirements for the Navajo Tribe on this flood control survey and any potential project that may result thereto?

Mr. PAGE. No, Senator, not to my knowledge. I know that we have had other situations in which we have been asked to waive the cost-sharing requirements. I am not aware, however, that a waiver has been asked for on this project, and so I can't tell you whether or not a waiver could be granted.

Mr. DOYLE. Senator, we do have authority, as a result of the 1986 Water Resource Development Act, to make cost-sharing adjustments on flood control projects in those extreme circumstances where there is a demonstrated inability to pay. Were there to be any kind of an adjustment, it would, under current law, be granted under that authority. But we haven't looked at it as of this time.

Senator DECONCINI. The request hasn't been made yet.

Mr. DOYLE. The report hasn't proceeded far enough yet to ask the question.

Senator DECONCINI. So it is not foreclosed, but it has to be timely, is that what I am hearing?

Mr. DOYLE. Yes, sir.

CENTRAL ARIZONA PROJECT

Senator DECONCINI. Thank you.

Mr. Secretary, I want to pay particular thanks to Mr. Doyle. I want to take a couple of minutes to thank and commend the Corps and the Assistant Secretary's Office for their cooperation and responsiveness to the Arizona delegation and the Arizona water community throughout our negotiations in eliminating Cliff Dam from plan 6 of the Central Arizona project, and the search for alternative flood control measures for the valley cities in central Arizona.

I know that all of this has been somewhat of a strain on your agency, and I want you all to know that this is certainly one Senator who realizes how much time and commitment you all put into that to help us. I thank you publicly and will do so many, many times over.

Can you tell us, Mr. Secretary or Mr. Doyle, what is the status of the Corps of Engineers study that relates to the flood control studies at Horseshoe and Bartlett Dams?

Mr. DOYLE. Yes, sir. We are currently in the process of doing, for the Bureau of Reclamation, a reconnaissance-type study of the flood control needs and the alternative opportunities associated with Horseshoe and Bartlett Dams. My recollection is that the study will be completed by the end of this fiscal year.

ADDITIONAL PREPARED QUESTIONS SUBMITTED FOR THE RECORD

Senator DECONCINI. Thank you very much.

Thank you, Mr. Chairman. I will submit the balance of my questions on this and other projects to be answered for the record.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR DECONCINI

BISBEE, ARIZONA

Senator DECONCINI. As you know, language was included in the FY 88 Continuing Resolution directing the Corps to give priority under the Small Projects Authority to a flooding problem in Bisbee, Arizona.

Can you tell me what activities will be undertaken on this project in FY 88?

General HATCH. During Fiscal Year 1988 we are conducting a reconnaissance study under Section 205 of the Continuing Authorities Program to determine if it appears likely that a solution to the flooding problems in Bisbee can developed. The report is scheduled for completion in October 1988.

Senator DECONCINI. Have funds been included in the budget for Fiscal Year 1989 to continue activities in Bisbee?

General HATCH. Due to the dynamic nature of the Continuing Authorities Programs our budget request is programmatic rather than project specific, however, subject to the approvalof a favorable reconnaissance report, we should have sufficient funds in our Section 205 request to proceed with initiation of a cost shared feasibility study.

Senator DECONCINI. Can you explain what steps are necessary in order to resolve the flooding situation in Bisbee?

General HATCH. Current efforts have identified that potential solutions include, but are not limited to, reinforcement of the existing channel and upstream storage. During the ongoing reconnaissance study, emphasis is placed on conducting hydraulic and economic studies. Also, a critical issue is to determine the structural integrity of the existing 80-year-old channel. Preliminary cost estimates, project benefits and environmental impacts will then be developed for the proposed alternatives, to assess economic justification and to determine if there is a Federal interest.

SANTA CRUZ RIVER

Senator DECONCINI. In order to complete the feasibility study on flood control alternatives for the Santa Cruz River in the Pinal County area, it is my understanding that the Corps must gather additional data from the floods that occurred in October of 1983. what is the status of that interim study?

General HATCH. A Reevaluation Report on the Santa Cruz Interim, which reflects the impacts of the October 1983 flooding, has been completed and indicates that more detailed studies are justified. Those studies are required to ascertain
if there is a Federal interest in developing a solution to the flooding problem in Pinal County and to prepare the feasibility report. Coordination is underway with local interests to develop the necessary contract for cost sharing the study effort.

Senator DECONCINI. Does the Corps have the capability to complete the feasibility study in FY 89? If so, how much money is necessary to do this work?

General HATCH. The capabilities for Fiscal Year 1989 are still under review. As soon as a capability on the Lower Santa Cruz River study is available, it will be provided to the committee.

NOGALES WASH

Senator DECONCINI. Again, I appreciate all of the work and effort contributed by the Corps staff to Santa Cruz County and the Town of Nogales on the Nogales Wash Flood Control Project. I understand the cost-sharing agreement has been signed and the next step is a feasibility study.

What is the status of the feasibility study for the small project in Nogales?

General HATCH. The feasibility study of Nogales Wash has been completed and is currently under final review in the South Pacific Division. The Division Engineers Notice is expected in late March or early April 1988.

Senator DECONCINI. Does it appear that the project report will go to the Board of Rivers and Harbors this year and be approved?

General HATCH. We expect the Nogales Wash feasibility report to be presented to the Board of Engineers for Rivers and Harbors in 1988, and we are hopeful that it will be approved. The project has a benefit-to-cost ratio of about 2.1 to 1 at the current interest rate and is fully supported by the local sponsor, the Santa Cruz County Flood Control District.

Senator DECONCINI. Can you provide an anticipated schedule for getting this study approved?

General HATCH. The current schedule for approval of the Nogales Wash feasibility report is as follows:

Division Engineer Public Notice	April 1988
BERH Approval	June 1988
Complete State and Agency Review	February 1989
Report of Chief of Engineers	April 1989

BIRDSPRINGS BRIDGE, NAVAJO RESERVATION

Senator DECONCINI. It is my understanding that the COE is considering the construction of a bridge across the Little Colorado River near the Birdsprings community on the Navajo Reservation.

What is the status of that study?

General HATCH. The bridge crossing at the Little Colorado River is included with a series of road crossings impacted by flooding under evaluation in the reconnaissance phase of the Navajo Indian Reservation study. The site will receive further consideration in the feasibility study.

Senator DECONCINI. Does the Corps of Engineers have authority to construct a bridge for transportation purposes?

General HATCH. No Sir, the Corps does not. In accordance with the cost-sharing requirements of the Water Resources Development Act of 1986, construction of a highway bridge as a part of a Corps flood control project would be a local sponsor responsibility.

PLAN 6, CENTRAL ARIZONA PROJECT

Senator DECONCINI. Can you provide a schedule of anticipated dates for completion of the data collection for flood control on Horseshore and Bartlett Dams.

General HATCH. Yes, Sir. Information is scheduled to be provided to the Bureau at four milestone dates. These are:

Presentation of Overflows	March	1988
Upstream Storage Benefits	July	1988
Downstream Benefits and Costs	September	1988
Report	October	1988

Senator DECONCINI. As a result of last year's Cliff Dam Agreement, the Corps of Engineers will initiate downstream flood control studies under the Gila River and Tributaries authority in FY 89. Have funds been budgeted for this purpose?

General HATCH. No, Sir, we are awaiting the results of the study for the Bureau to determine the extent of effort required under the Gila River and Tributaries study.

Senator DECONCINI. What is the Corps' capability requirement for this work in FY 89?

General HATCH. Sir, capabilities are still under review and will be provided to the committee as soon as they are available.

Senator DECONCINI. There seems to be a little confusion over what was expected of the Corps in relation to these downstream studies. Can you provide for the record an anticipated schedule of work to be completed for the downstream flood control studies?

General HATCH. Following completion of reconnaissance level studies in October 1988, a more detailed evaluation of flood control alternatives will be necessary. How and when this evaluation would be pursued is a subject of the final negotiation of work to be accomplished under the terms of the Bureau and Corps interagency agreement.

GILA RIVER INDIAN RESERVATION

Senator DECONCINI. I understand the Corps has had ongoing discussions with tribal officials from the Gila River Indian Reservation concerning a comprehensive water resources investigation.

I notice no funds have been requested in the FY 89 budget for initiation of the appropriate studies. What priority has the Corps of Engineers placed on the Gila River Indian community's request for a comprehensive water resources plan?

General HATCH. We are concerned about the water resources problems experienced by the Gila River Indian Community; however, our manpower and funding limitations precluded a recommendation for a new study in an area where limited resources are committed to ongoing activities.

Senator DECONCINI. I further understand that the Corps could use about $500,000 in FY 89 to start the reconnaisance phase. Does this figure sound about right?

General HATCH. Yes, sir, I believe we could perform the necessary reconnaissance study for about $500,000; however, capabilities are still under review and will be provided to the committee as soon as they are available.

Senator DECONCINI. Does the Corps have sufficient authorization for this work or is additional authorization necessary?

General HATCH. Yes, sir, the study can be conducted under the Gila River and Tributaries authority in the 1938 Flood Control Act.

PHOENIX, ARIZONA AND VICINITY
ADOBE DAM CULTURAL RESOURCES FACILITY

Senator DECONCINI. Is there a problem with the construction of a public cultural resources facility for viewing and access to protected rock art at or near the Adobe Dam construction site?

General HATCH. No, sir. There is no problem with the Corps proceeding to construct the Cultural Resources Interpretive Center at Adobe Dam. We are fully committed to preserving the cultural resources of the Phoenix and Vicinity project and in protecting the rock art. There has, however, been some confusion over the intent of Corps actions spelled out in the Memorandum of Agreement signed by the Corps, the local sponsor, and the National Advisory Concil for Cultural Resources, specifically with respect to the size and the purpose of the proposed center. It is our policy that the Corps will not fund the laboratory and auditorium portions of the center, as desired by Arizona State University. The matter is still being discussed and we are hopeful of an early resolution.

Senator DECONCINI. Arizona State University believes the facility should be used not only for educational purposes, but be open to the public for tours and visitation. Can this be accomplished?

General HATCH. Yes, sir. If the local sponsor is willing to provide those facilities, and operate and maintain the facilities.

Senator DECONCINI. Is funding a problem?

General HATCH. Yes, the Corps will not recommend funding for construction of a facility for all the functions hoped for by the University and others, and as
of this date, no alternative source of funding has been identified.

Senator DECONCINI. I further understand that the Corps has made a policy decision to scale back the proposed Center and has changed the original site location from the Hedgepeth Hills Petroglyph site.
Is this true? If so, please explain the reasons for the changes from the Memorandum of Agreement entered into the Arizona State University.

General HATCH. The Corps has not made a policy decision to scale back the Cultural Resources Interpretive Center. We have, however, pointed out that the plan under consideration by the University includes facilities for purposes beyond the scope and intent of the Memorandum of Agreement.
A Memorandum Of Agreement (MOA) was signed by the Corps, the Arizona State Historic Preservation Officer, the Advisory Council on Historic Preservation, and the Flood Control District of Maricopa County. This agreement defined the general requirements for cultural resources mitigation for the Phoenix and Vicinity project. The agreement does not directly specify construction of the Cultural Resources Interpretive Center. To date, no MOA has been entered into with Arizona State University. One was being negotiated for long term operation and maintenance of the facility when the policy decision was made that the Cultural Resources Interpertive Center, as it was being planned, went beyond the requirements of the initial MOA and would result in unjustified Federal expenditures.

Senator DECONCINI. Can't we work out some kind of solution that is amenable to both the City of Phoenix and Arizona State University?

General HATCH. We hope so. We have been looking at a number of potential solutions that will best satisfy not only the City of Phoenix and Arizona State University, but also the Corps, the Flood Control District of Maricopa County, and a number of groups and agencies interested in archeology. To date, no solution has been identified, although it appears that an acceptable solution may be imminent.

CAPABILITY

Senator DECONCINI. For all of the Arizona projects where funds have been budgeted, does the Corps have additional capability?

General HATCH. The Corps' capabilities for Fiscal Year 1989 are still under review. As soon as they are approved, we will provide them to the committee.

SHEYENNE RIVER, WEST FARGO, AND RIVERSIDE, N. DAK.

Senator JOHNSTON. The Senator from North Dakota.

Senator BURDICK. Thank you, Mr. Chairman.

Mr. Secretary, I have a few questions concerning the Corps program in the state of North Dakota.

I am extremely pleased to note that you intend to start construction on the Sheyenne River project with funds to be included in the fiscal year 1989 appropriations bill.

Flood waters caused $98 million in damages in this part of the state in 1975. Local sponsors of the project are going to contribute more than 40 percent of the total cost of this project, and that is a pretty high percentage compared to projects I have been associated with in the past.

I believe that we need to get this project constructed as quickly as possible, and that brings me to my first question.

What is the anticipated schedule of expenditures for the West Fargo unit of the Sheyenne River project from fiscal year 1989 to its completion?

Mr. PAGE. Sir, if I may, I will read from the document. I believe it is correct that the construction of West Fargo and Riverside unit is scheduled to begin in the third quarter of fiscal year 1989.

The outyear schedule for this project extends through fiscal year 1993 with a flow of expenditures of $7.5 million, $3 million, $590,000, and $300,000.

Senator BURDICK. Is this the optimum construction schedule, or could you build it faster?

Mr. PAGE. There is always the possibility that we could build it faster, Senator, but I don't think so. I believe that this would be the optimum. It is the most feasible way to build the project.

Senator BURDICK. When the floods come, we can't wait a couple of years, it is there.

Mr. PAGE. We will look at the schedule, Senator, and if changes are warranted, we will get back to you.

SOURIS RIVER BASIN, RAFFERTY AND ALAMEDA DAMS, SASKATCHEWAN, CANADA

Senator BURDICK. Mr. Secretary, your office was very helpful in continuing to work with the representatives of my state and the various federal agencies toward an agreement with Canada for the inclusion of flood storage space in two reservoirs which the Canadians are going to construct on the Souris River.

Can you tell me what progress has been made toward completion of the Corps environmental impact statement on this payment to Canada, and can you give me an estimate of when the EIS will be completed?

General HEIBERG. I can answer that, sir. We are expecting to file that EIS, I was going to say in July, but I am about to be corrected.

Mr. DOYLE. Originally it was projected to be July, but we have just learned that we are not going to be able to meet that deadline, Senator. We are working with the district to find out what the new revised deadline is going to be.

The July 1988 schedule has changed to November 1988 because additional time is required to respond to extensive comments received on the draft EIS.

Senator BURDICK. I am a little bit shocked. The last time I talked to the Corps, they thought that they might be able to expedite that.

Mr. DOYLE. We were all extremely optimistic that we would not get the kinds of comments and type of issues that, in fact, have been raised. It is just going to take us more time than we originally projected.

General HEIBERG. Sir, on the business of the EIS, this is a particularly difficult one. There are a number of other agencies involved. It does not make it different from the other EIS's. But this is one of those statements which, based on my experience over the last 10 or 12 years, if you are not careful and do it on a deliberate and responsive basis, then you are liable to end up spending more time rather than less.

Senator BURDICK. I want the shortest possible route, of course.

General HEIBERG. But you also want it to be a successful route, sir.

Senator BURDICK. I want a safe trip.

General HEIBERG. Yes, sir.

USE OF ENGINEERING FIRMS

Senator BURDICK. Finally, Mr. Secretary, I recently received a number of letters from small and medium size engineering firms in North Dakota stating that your offices in St. Paul and Omaha do not adequately consider the capabilities of private engineering firms in the state when awarding contracts for projects constructed in North Dakota. Are they getting a fair shake in North Dakota, those smaller firms?

Mr. PAGE. Yes, sir; do you want anything for the record? Do you want a list of what we have reviewed with small firms?

Senator BURDICK. You have a record of construction contracts over the last 10 years?

Mr. PAGE. I do not have a record for the past 10 years. However, I will provide for the record a detailed listing of service, supply, A–E, and construction contracts for the Missouri River Division in North Dakota, including contract amounts for fiscal years 1987, 1988, and 1989. The table shows that many smaller North Dakota firms have been awarded contracts in the state.

Senator BURDICK. Fine.

[The information follows:]

CONTRACTS IN NORTH DAKOTA

PROJECT/CONTRACTOR	DESCRIPTION OF WORK	CONTRACT TYPE	-------CONTRACT AMOUNT------- FY87	FY88	FY89
GARRISON DAM - LAKE SAKAKAWEA					
McLean County Sheriff Department	Law enforcement	Service	16,000	12,501	3,873
Sylvia Enyart PO Box 502, Riverdale, ND 58565	Janitorial - administration building	Service	6,240	11,064	
Larry B. Alveshere Box 813, Riverdale, ND 58565	Refuse removal - recreation areas	Service	9,000	11,200	
	Mowing - recreation areas	Service	5,860	5,860	
Mark Markert PO Box 862, Garrison, ND 58540	Janitorial - powerplant, spillway, and intake structure	Service	5,000	13,640	11,160
George Bischoff Box 232, Rugby, ND 58368	Comfort station cleaning	Service	2,372		
Melvin Link Rt 1, Box 86, Brunswick, MO 65236	Comfort station cleaning	Service	3,275		
C. Ihringer Box 598, Underwood, ND 58576	Vault toilet cleaning	Service	8,605	8,605	
Damel Mahan Box 768, Garrison, ND 58540	Mowing - recreation areas	Service	6,620		
	Trash removal	Service	4,320		
Ewald Gierman PO Box 834, Riverdale, ND 58565	Trash removal	Service	780		
Trash-A-Way Rt 4, Box 45, Williston, ND 58801	Trash removal	Service	312		
*	Service contracts at Garrison area	Service			83,000
*	Law enforcement at Garrison area	Service			15,000
McLean County PO Box D, Washburn, ND 58557	Riprap and raising of McLean County Road 8	Constr	27,300	14,700	
Teledyne, 12333 West Olympic Blvd, Los Angeles, CA 90064	Power plant control system	Supply	56,200	70,000	
McGraw Edison, 941 Chatham Lane Columbus, OH 43221	Power plant stator windings	Service	316,500		
Siemens Allis, 10965 Granada Lane Overland Park, KS 66211	Power plant voltage regulators	Supply	475,500	18,000	
Tanyer Coatings, PO Box 192 Badger, MN 56714	Finish painting No.2 surge tank, pwr plant	Constr	19,900		
	Rehab spillway & paint emergency gates	Constr	40,000	259,000	
Serck Heat Transfer, Inc PO Box 187, Sussex, WI 53089	Heat exchanger rehab in power plant	Supply	122,300		
ISOREG Corporation 410 Great Road, Littleton, MA 01460	Five neutral grounding transformers	Supply	14,300		
Bechtold Paving, Inc RR 5, Box 6, Minot,ND 58701	Pavement repairs	Constr	160,406		
Greenberg Roofing and Sheet Metal PO Box 397, Grand Forks, ND 58206	Repair power plant and intake struct. roofs	Constr	206,600		
Singleton Contracting Corporation PO Box 19864, Sta. N, Atlanta, GA 30325	Paint No. 4 surge tank in power plant	Constr	30,000	238,059	
Scherr Construction Co. PO Box 608, Valley City, ND 58072	Project maintenance garage & equip. bldg.	Constr	1,318,600	400,000	
Richard Swartz, Inc., 1123 Highland Park Rd Glendive, MT 59330	Repair draft tube piers	Constr		89,500	

CONTRACTS IN NORTH DAKOTA

PROJECT/CONTRACTOR	DESCRIPTION OF WORK	CONTRACT TYPE	------CONTRACT AMOUNT------ FY87	FY88	FY89
GARRISON DAM - LAKE SAKAKAWEA					
Helen Construction Co. Box 126, McClusky, ND 58463	Riprap repair, spillway and dam embankment	Constr		86,918	
Powers Elevation, Inc. PO Box 2612, Denver, CO 80201	Cultural resource survey, Mercer County	AE	20,000	31,400	
"	Generator protective relay	Supply		72,000	
"	Replace two 16" strainers	Supply		36,000	
"	Repair three hydraulic turbine governors	Supply		30,000	
"	Replace battery chargers & emerg. power inv.	Supply		50,000	
"	Fence archeological site, Ft. Berthold	AE		23,000	
"	Tree planting, Joint Tribal Adv. Committee	Service		38,000	
"	Williston levee grading & outfall pipe inst.	Constr		65,000	
"	Computerized maintenance management system	Supply		65,000	
"	Project telephone equipment	Supply		50,000	
"	Cultural resource survey, McLean County	AE		30,000	
"	Cultural resource site test, White Earth Bay	AE		10,000	
"	Cultural resource site, Ft. Berthold	AE		27,000	
"	Rehab intake gates and roller chains	Constr			300,000
"	Initiate painting of No. 3 surge tank	Constr			225,000
"	Mitigate Medi Podi Butte	Constr			25,000
"	Upgrade spillway bridge railing	Constr			110,000
Schemmer & Associates 10830 Old Mill Road, Omaha, NE	Intake structure roof	AE	11,000		
North Central Consultants Jamestown, ND	Range survey	AE	66,000		
B & E Engineering, Yankton, SD	Hydrographic survey	AE	55,000		
			--------	--------	--------
Subtotal, Garrison:			3,007,990	1,766,447	773,033
OAHE DAM - LAKE OAHE					
Office of the County Commissioner Emmons County Crthse, Linton, ND 58552	Law enforcement	Service	12,102		
"	Law enforcement	Service		12,102	12,102
Wayne Godkin 215 E. 8th D-6, Pierre, SD 57501	Cleanup and mowing of recreaction areas	Service	24,710		
Schoonover Brothers RR 2, Box 123B, Mandan, ND 58554	Riprap for Beaver Cr. & Ft. Yates rec. areas	Supply	24,310		
	Shoreline erosion protection near Ft. Yates	Constr		83,176	
Big River Construction Co. Nebraska City, NE 68410	Bank stabilization, Havens archeolog. site	Constr		97,008	
"	Electrical service, Beaver Crk Recr Area	Constr		47,000	

CONTRACTS IN NORTH DAKOTA

PROJECT/CONTRACTOR	DESCRIPTION OF WORK	CONTRACT TYPE	CONTRACT AMOUNT FY87	FY88	FY89
OAHE DAM - LAKE OAHE					
*	Cleanup and mowing of recr. areas in ND	Service		25,000	25,000
Aberdeen Sewer Service Box 1051, Aberdeen, SD 57401	Clean vault toilets, recr. areas in ND	Service	4,110		
*	Clean vault toilets, recr. areas in ND	Service		4,110	4,110
Subtotal, Oahe:			65,232	268,396	41,212
PIPESTEM LAKE					
*	Install new dam crest guard rails	Constr		130,000	
Subtotal, Pipestem:			0	130,000	0
BOWMAN-HALEY LAKE					
Redford Diving and Salvage, Inc 953 Slater Road, Bellingham, WA 98226	Outlet modification	Constr		57,770	
Subtotal, Bowman-Haley:			0	57,770	0
GRAND TOTALS:			3,073,222	2,222,613	814,245

* contract not yet awarded

Mr. PAGE. I think that it has been the policy, and correct me if I am not correct, General Heiberg, we have always tended, wherever possible, to work with local, small or large, engineering and construction firms. In some cases, you can't find the expertise that you need locally, but in all cases, I think, an extreme effort is made to work with local firms.

HEARING ON AUTHORIZING LEGISLATION

Senator BURDICK. Thank you, Mr. Secretary. I have no further questions at this time, but I look forward to your testimony in about 2 weeks in the Environment and Public Works Committee on the omnibus water resource legislation.

I believe we share the view that it is time to take the uncertainty out of the authorization process for Corps projects. To do this, we need to enact routine and noncontroversial omnibus legislation every 2 or 3 years. I am looking forward to discussing it with you in more detail later this month.

Senator JOHNSTON. Thank you, Senator Burdick.

Senator Specter.

PRESQUE ISLE PENINSULA, PA.

Senator SPECTER. Thank you, Mr. Chairman.

At the outset, gentlemen, let me compliment you for your good work and thank you for the kind of cooperation that you have shown in so many of the Pennsylvania projects. We have had a very good working relationship with the Army Corps of Engineers, and I want to publicly thank you for that.

One subject that I would like to take up with you at the moment. I am delighted that we have finally been able to move ahead with Presque Isle, a matter which is of enormous importance, I think, not only to Erie and northwestern Pennsylvania, but really to the country as a very major recreational site. With the kind of plans which are now on the books to complete it, I think that it will do a great deal for Presque Isle.

SAND QUALITY

There is a current problem of some moment, which I want to bring to your attention. I note that on the nourishment program there is $1,230,000, which is allocated for Presque Isle, but the quality of the sand which goes there has been a recurring difficulty. One year, we had problems with some pebbles that were on the beach. Now there is a major furor with the quality of the sand. I would ask you to take a look at it.

That issue coincides with this hearing, so I call it to your attention to save on my franked envelopes and attract some early attention. The people of the area would be very appreciative if you would take a look at it.

General HEIBERG. Sir, we will certainly do that. Either General Hatch or I will get back to you after we discuss this with General Vander Els and the District Engineer.

Senator SPECTER. I would appreciate it.

In your positions, you hear lots of comments from lots of citizens as I do. There is a group that I deal with which is very concerned as a matter of local pride—the citizens of Erie about Presque Isle. It is a matter of enormous public interest and public concern. I haven't seen the sand. I am due to get there next week. My being able to carry your personal assurances that you will take a look at that issue will mean a lot to them and a lot to me.

General HATCH. Sir, if I may, last summer, I had a chance to be up there and sift through that sand on my hands and knees. I am very familiar with it, and very familiar with the issues, and we do have a bit of a catch-22. The coarser the material, the less pleasant it is for bathers and users of the beach. However, it will stay on the beach longer. So we have to balance the two.

We are very sensitive to the concerns of the recreating public up there and the sand we provide is reasonable for placing on a beach.

Senator SPECTER. We want to keep the beach, but we also want to keep the bathers.

General HATCH. Yes, sir; I understand.

Senator SPECTER. If we just have the beach and no bathers, we might as well not have the beach. I understand that it is a matter of balance, and it may be a matter of cost, but if you would take a look at it and do your utmost to solve that problem, I would be very grateful.

RESPONSIVENESS TO LOCAL CONCERNS

Meanwhile, we have quite a number of other projects. We have had some especially responsive notes on some of the difficulties of the Wilkes-Barre area where there has been flooding, and your representatives out of Baltimore are always terrific in coming up and taking a look at it.

The availability of the Corps to go to a spot and look at the issues, and give that kind of personalized attention means a tremendous, tremendous amount, because when the people see that you are willing to go there and look at it, that is a big part of the battle. If you can help them, great. But if you are at least willing to consider what they do and come to the spot in a very timely manner, that is a very important factor. I compliment you on your responsiveness to those issues.

Thank you, Mr. Chairman.

CALCULATION OF BENEFIT-COST RATIO

Senator JOHNSTON. General Heiberg, one of the least understood things about the federal government is how the Corps does its benefit-cost calculations. Every year, we have one small publication down in our country that still, in spite of the evidence, does not seem to understand these benefit-cost calculations.

As I understand it, the benefits are not adjusted for inflation. Initially, costs were adjusted only to reflect the real rate of interest which I think they set in the statute way back when, I think once at 5.59 percent and another time at 2.25 percent, but that was to reflect the real rate of interest which was the real cost to the government of borrowing.

Somewhere in the ensuing years, some smart people in the Congress or out in the public came along and said the government is saying that they are borrowing money at 2.25 percent, when we know they have to pay much more than that. So they would require the Corps to jack up that side of the equation, all the while leaving the benefits unadjusted.

Am I correctly describing that? If that is so, why doesn't the Corps suggest to us a new way to calculate benefit-cost ratio that accurately reflects what is happening—I would suggest that they use the actual rates of interest, and use the consequent actual rates of inflation that are reflected by whatever rates of interest you use, in other words, adjust both sides of the equation.

Would you speak to that issue?

General HEIBERG. Yes, sir. We talked about that a bit last year, and you quickly noticed that I passed the question on to others. I have found, over the years, that if you ask three economists to answer the question, you get at least four answers back. However, let me try to answer the question then see where we go from there. I am sure my colleagues might want to help me with this.

PROJECT DISCOUNT RATE

You are correct that we do evaluate our projects benefits and costs in real terms. And, I might add, there is no jacking up of costs to reflect inflation. The discount rate which is applied to both benefits and costs is based on government securities. And that rate does include an inflation factor. I have for a long time, long years before I came to this job, been concerned personally with the question—is the resulting discount rate too high?

I have kicked this around. I have kicked this around inside the Corps, with my colleagues in Mr. Page's office, and several economists outside the Corps of Engineers. Let me give you some of the views that I have gotten back, and then tell you what I think.

One view of at least two economists that are today in academia, who are prestigious economists, is that if you have a measure of the benefits and costs from a project that are both inflation-free and risk-free, then the current rate of 8⅝ that we use by law is, indeed, too high.

On the other side, others have argued that inflation-free opportunity cost of capital is a proper standard for water resource projects. The Office of Management and Budget today, which is the spokesman for the President in this area, estimates that to be 10 percent.

I think that it is worthwhile to revisit the issue——

Senator JOHNSTON. Inflation-free opportunity cost of capital is 10 percent?

General HEIBERG. That is OMB's current testing percentage; yes, sir.

Senator JOHNSTON. Isn't that patently absurd?

General HEIBERG. I haven't quite gotten down to my view, sir.

Senator JOHNSTON. Isn't that absurd on its face?

General HEIBERG. That is why I had a problem with it, sir.

Senator JOHNSTON. Inflation-free cost of capital at 10 percent.

APPLICATION OF DISCOUNT RATE

General HEIBERG. What I think you need to do is balance the benefits and the costs using a discount rate that gives you an equal measure. Our problem has been explaining why the 10 percent, or even the 8 5/8 rate which we are now using permits an inflation-free comparison.

I think there is a way to obey the law—in other words, go along with the formula that the Congress and the administration both recognize now, which is the basis for deriving the 8 5/8 rate—and still apply some other factors to provide another test for the projects.

I can't tell you what the procedure is, but I think one could be developed. I am prepared to work with your staff, with Mr. Page's permission, and take a more in-depth look at this question and see if we can't, without promising anything for the future, come up with some other ways to test a project.

Senator JOHNSTON. Do we have that permission, Mr. Page?

Mr. PAGE. Yes, sir; if you do that right away, maybe we will find out something.

CURRENT PROCEDURES

Mr. DOYLE. Senator, with your permission, we will, for the record, provide the best defense we can for the current procedure so that that is on the record as well.

Senator JOHNSTON. The best defense for it?

Mr. DOYLE. Yes; the best explanation for it, as we understand it.

Senator JOHNSTON. If, in fact, what I said initially was correct that, in effect, you are supposed to consider benefits as inflation free—when we get a weapon system, we always talk about constant dollars—so we are talking about constant benefits. Then on the interest side, it was supposed to be the real cost of capital, or the opportunity cost, which is, I think, another way of saying the same thing, in effect, the difference between interest rate and inflation rate.

If that was the theory, then you cannot defend using an artificially and statutorily imposed figure which exceeds that, can you?

Mr. DOYLE. The current procedures were developed after a great deal of debate, public comment, discussion, and criticism, and have been in place for many years.

Senator JOHNSTON. The 8 5/8 percent?

General HEIBERG. The formula for the rate; the rate has varied, but it is currently 8 5/8 percent.

Mr. DOYLE. The 1974 Act tells us how to adjust the discount rate.

Senator JOHNSTON. I know, but that wasn't arrived at by a lot of economists figuring out what the opportunity cost of capital or the real rate of interest was. That was imposed politically by a bunch of people in my position who didn't have the foggiest notion of what the formula was all about.

Mr. DOYLE. Not having been here then, you are in a better position to answer that.

Senator JOHNSTON. It is not unusual that people don't have the foggiest notion what the formula is all about.

Mr. DOYLE. There is a body of economists that does believe that the current practice is defensible. I think, in order for you to be able to have the complete picture, what we need to do, as part of your consideration, is get you a definitive explanation of the current procedures, as well as whatever additional information you may want on other alternatives.

[The information follows:]

EXPLANATION OF DISCOUNT RATE

When the Corps of Engineers undertakes an economic analysis of a water resource project, it evaluates both costs and benefits in "constant dollars"; estimates of costs and benefits are not tied to a factor which accounts for future inflation. This procedure is used as a basis for determining the value of a project in terms of the flows of goods and services it produces relative to its cost. Normally, prices of goods and services used to evaluate the benefit-cost ratio for a water resource project are those prevailing during the period of planning. These are taken to represent the real value relationships expected over the life of the project unless some specific evidence indicates that the real exchange values are expected to change. Expected changes in economic activity, e.g. changes in structures on a flood plain, or level of traffic on a waterway, are included in the analysis, but without projection of relative price shifts. Because of the use of inflation free estimates, the discount rate (which permits comparison of costs and benefits occurring at different points in time) should also be inflation free.

The discount rate formula currently used in the formulation and evaluation of Federal water resource projects is provided for in the Water Resources Development Act of 1974. Section 80(a) of this act states that the formula shall be the one approved by the President on May 15, 1962, published as Senate Document 97 on May 29, 1962, as amended by the regulation issued by the Water Resources Council and published in the Federal Register on December 24, 1968. This formula provides that the discount rate shall be based upon the average yield during the preceding fiscal year on interest-bearing marketable securities of the United States which, at the time the computation is made, have terms of 15 years or more remaining to maturity. Provided, however, that in no event shall the rate be raised or lowered more than one quarter of 1 percent for any year. For fiscal year 1988, this rate is 8 5/8 percent.

The yield on long term government bonds is a "nominal rate", that is, it includes an inflation premium. On this basis, some have argued that the current formula results in too high an estimate of a "proper" discount rate. On the other hand, unlike a water resource project, a government bond is a no risk, highly liquid asset. The current procedure may therefore result in an understatement of the most appropriate discount rate. On balance, while the current rate is tied to an arbitrary formula, it is within the range of estimates of real returns on private sector investments in new plant and equipment. In fact, the current rate is less than the estimate of 10 percent, made by the Office of Management and Budget (OMB) to be used in evaluating Federal projects that do not involve water resources.

In our view, the discount rate should reflect the opportunity cost of land, labor, and capital resources diverted from private to public investment. This should be the normal rate of return expected from capital investments in the private sector which would enhance the national income, as measured by the flow of goods and services produced in the economy.

OMB's estimate of 10 percent, published in Circular A-94, is intended to be a measure of the real return on capital investments. It is based on empirical data from economic studies conducted at the time the circular was written. More recent data confirm this estimate. For example, Standard & Poor's Compustat Services Inc. provides estimates of the industry composite nominal rate of return on invested capital. For 1983-86, the industry composite return averaged 15.6 percent. The difference of 5.6 percent between Compustat's nominal return and OMB's estimated real rate of return can be interpreted as a measure of expected inflation.

FURTHER CONSIDERATIONS

Senator JOHNSTON. I am not looking for a pollyanna system. I want one that we can be able to defend. Even I know that if benefits are inflation-free, then you ought to have a similar treatment on the other side of the ledger. You just can't have it both ways that you inflate one side and you don't inflate the other side.

I would submit to you that a 10-percent inflation-free opportunity cost of capital, if that is what OMB does, is patently absurd. It is not just unsupportable, it is patently absurd, because that would mean a real opportunity cost of capital to be inflation, which is now running 5.4 percent, it was supposed to be this year, which would mean that the opportunity cost of capital is 15.4 percent. There are not that many Fortune 500 companies that make that kind of return.

It just doesn't add up, and if that is what it is, we ought to write that in, we are assuming that the opportunity cost of capital is inflation plus 10 percent, and then people would understand.

General HEIBERG. Sir, you have heard my discomfort level on the whole question. There is another area that the economists will talk about that we haven't discussed here, and that is some way to evaluate what the economists call the risk factor in government investment. This also is an important question for any reconsideration of the discount rate which would be applied to both the cost and benefit sides.

Again, I come back to what I originally said. I feel that this is an excellent time, and you have given us an opportunity, to have some discussions. Understanding that I am certainly not in a position to promise that the government is going to change its position, I do think that further discussions will be very useful, provided some economists from both sides do participate.

Senator JOHNSTON. I have a number of other questions, but Senator Sasser wanted to ask some quick questions before the vote. As you can imagine, I am most anxious to talk about Red River, but let me submit those questions in writing, and urge you to optimize the schedule on Red River. My questions have to do with that. I also have a number of other questions in writing. With that let me turn it over to Senator Sasser.

Senator Sasser, if you want to finish your questions before the vote, that is fine. If you would like to come back, we will.

MEMPHIS HARBOR, ENSLEY BERM, TENN.

Senator SASSER. Mr. Chairman, I have just a quick comment to make, and that is all I have, and it will take literally 30 seconds.

I would like to take this opportunity, Mr. Chairman, to express my appreciation to Secretary Page for his commitment to make a personal visit to the Memphis Harbor in Memphis, Tenn.

Secretary Page has a reputation of being an excellent engineer, and I believe that when he personally inspects the Ensley berm in the Memphis Harbor that he will agree there is, indeed, a project deficiency there.

It is my understanding, Mr. Secretary, that you had planned to visit Memphis on March 21, but had to reschedule that. If possible, when you reschedule, I would like to join you on this inspection trip.

Mr. PAGE. Yes, sir; I wanted to notify your office, and we did, that we would make that trip on that date. Since then, another commitment arose which involves about a 3-day or 4-day period around that date. We are going back to your office to reestablish a new date but not too much later. I certainly will let you know, and I hope that we can go there together.

Senator SASSER. I thank you, Mr. Secretary.

Mr. Chairman, as you know, the committee has included language in last year's bill on this Ensley berm project in Memphis Harbor, and I would hope that the language is sufficient to get the job done. I would like to keep the record open, Mr. Chairman, to reflect the results of Secretary Page's visit to Memphis Harbor to inspect this project. I assume that the Chair will have no objection to keeping the record open for that purpose.

ADDITIONAL QUESTIONS SUBMITTED FOR THE RECORD

Senator JOHNSTON. Yes, of course, we will keep the record open for written questions by all Members, especially Senator Domenici who asked specifically for that, but we will have other Senator as well who will submit questions in writing and to make comments for the record.

Senator SASSER. We want to keep it open to get the results of the Secretary's inspection of this project.

Senator JOHNSTON. Absolutely.

Senator SASSER. Thank you, Mr. Chairman.

Senator JOHNSTON. We will also keep it open to get the Secretary's response to our questions on the mapping and on the coastal resource atlas.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR JOHNSTON

GRAMM-RUDMAN PROCESS

Senator JOHNSTON. State and local governments are now required to put up their funds (costsharing) to maintain construction schedules on a project. Yet, Gramm-Rudman could require sequestration and necessarily delay projects. What do you tell local governments about this possibility?

Mr. PAGE. We do not specifically indicate to a non-Federal sponsor the potential impacts of Gramm-Rudman sequestrations. However, one of the standard clauses in our local cooperation agreement with each non-Federal sponsor states that if the Government fails to receive annual appropriations in amounts sufficient to meet project expenditures for the then current or upcoming fiscal year, the Government shall so notify the non-Federal sponsor. Furthermore, after 60 days, either party may elect, without penalty, to terminate the agreement or to suspend performance thereunder. Nevertheless, if any sequestration were not excessive and surplus funds were available from other projects, we would reprogram available funds to alleviate the sequestrations within the limits of our general guidelines for reprogramming actions.

CORPS MANPOWER LEVELS

Senator JOHNSTON. General Heiberg, I'm concerned that after a few years, it will be difficult for the Corps to maintain its current manpower levels. Inasmuch as your people are generally paid out of project funds and your workload will be gradually declining as a smaller number of projects are undertaken, it appears that the Corps will be confronted with difficult decisions in maintaining desireable personnel/manpower strengths. Are you concerned or is this just a short-term adjustment?

General HEIBERG. I continue to be concerned with manpower reductions but we have been able to adjust our workforce and make the best of a challenging situation. With of the passage of the Water Resources Development Act in 1986 and the implementation of new cost-sharing policies, we will experience moderate and steady growth in our planning, engineering and construction programs over the next several years. We will accomplish the additional workload by (1) shifting existing personnel into the fields of design and construction from other work functions; (2) increasing contracting of workload in other work functions, if needed; and (3) increasing use of centers of expertise, where warranted.

NEW STREAMLINED PLANNING AND APPROVAL PROCEDURES

Senator JOHNSTON: Mr. Page, you have indicated (page 14 of his statement) that you plan to implement changes designed to accelerate the study and planning process. Would you explain this in more detail, particularly how it impacts to the orderly execution and completion of feasibility and planning reports requested by the Congress?

Mr. PAGE: Our objective is to accelerate the completion of feasibility and planning reports so that projects feasible for Federal pursuit may be implemented in a reasonable time within costs and schedules developed during the feasibility stage. To accomplish that objective we are proceeding with guidelines to District Engineers, early review of major projects by my office and the Corps Headquarters experts, and acceleration of the Washington level review within the requirements of current law. So that we may refine procedures for accomplishing this objective we are selecting a few early projects for testing. We will develop permanent procedures to facilitate our recommendations to Congress for project authorization based upon feasibility studies. Additionally, upon our early approval of the major projects before they are finalized in the District, we will commit to support continuous funding and further activities on that project until completion.

Senator JOHNSTON: It appears that these procedures will confine the evaluation process to those functions and areas determined by Administration policy while prohibiting the Corps of Engineers from analyzing all areas in order to recommend the best project in the Corps' judgment?

Mr. PAGE: The evaluation process will continue to be in accordance with the Water Resources Council Principles and Guidelines. In this new cost-sharing environment created by the Water Resources Development Act of 1986, the greatest impact on determining which plan the Corps of Engineers would recommend in the feasibility report, will likely result from increased non-Federal involvement.

The new approval procedures will focus on reducing the overall review time. This will be accomplished in part by having early Washington level involvement in the feasibility phase. This is intended to facilitate resolution of policy and formulation issues early-on and expedite review of the report when completed by the District Engineer.

From an overall program perspective we will continue to support those studies and projects consistent with the Administration priorities.

Senator JOHNSTON: Aren't we really describing what an "approvable study" will be before the analysis begins?

Mr. PAGE: What I've been describing are measures which when implemented will remove some of the gaps or dead spots in the project planning and approval process. To be responsive to our cost sharing partners it is imperative that we seize every opportunity to do our job more efficiently and improve the quality of the products.

Senator JOHNSTON: Will the Corps be allowed to present for public review and comment, and ultimately for Congressional consideration, the results of their unencumbered engineering analysis.

Mr. PAGE: Corps analysis has always been developed within a policy framework and I do not anticipate that there would be any change to that. The thrust of our initiatives is to enable the feasibility report to move to Congress without the extensive review delays occurring in the past.

ORDERLY PROJECT REVIEW

Senator JOHNSTON: General Heiberg, on page 8 of your statement, you urge the Congress to rely on the orderly review of projects by the Executive Branch. Could you explain this in more detail?

General HEIBERG: In the past, key projects have been funded for construction based on the Division Engineer's Report without benefit of technical and policy review by my office, BERH, or the Assistant Secretary's office. Under the new system which cost sharing mandated and which Secretary Page's new initiative for early approval will assure, problems will be surfaced early in the review process so that studies which do not involve a Federal role can be redirected or stopped.

Senator JOHNSTON: Are you saying that Congress should not be able to review a particular project just because the Administration for whatever policy or other arbitrary reason wishes not to recommend it.

General HEIBERG: No, sir. I do believe that with increased cost sharing and sponsor involvement, good projects will continue to move through the system and be recommended to Congress in the President's budget, as they have in recent years. Of course, Congress will still have the prerogative to reallocate funding to any study or project that meets its own criteria.

LOW PRIORITY O&M PROJECTS

Senator JOHNSON. General Heiberg, on page 18 you mention low priority commercial and recreation projects where operation and maintenance will be reduced.

What criteria was used to evaluate these projects?

LTG HEIBERG. Regarding recreation projects, we selected projects where our actions would have the least impact on recreational users. Our primary objective was to continue to assure the health and safety of the public who come to our projects.

Regarding lower priority commercial projects, these were evaluated initially based upon the officially reported amount of commercial tonnage on that project. Subsequent evaluation factors were designation as a defense port, criticality of commodities carried, housing of US Coast Guard facilities at that harbor, and finally recreational usage of that project.

Senator JOHNSON. Is O&M on any project being eliminated?

LTG HEIBERG. O&M of projects is not being eliminated but deferred where the impact on users is minimized. Channel condition surveys and user reports will be monitored in the year of execution so that shoaling rates and locations do not force the closure of channels to navigation traffic, thus reducing the impediment to any local industry or commerce.

Senator JOHNSTON. Provide for the record a full list of those projects impacted.

LTG HEIBERG. The Corps FY 1989 recreation program reflects a reduction in order to allow budgeting for follow-on requirements of projects and studies in the FY 1988 Continuing Resolution Act, while remaining consistent with the Bipartisan Budget Agreement. The attached listing shows by state and by project potential activity approximating the amount that our requested FY 1989 recreation program is exceeded by the FY 1988 program. Since dredging needs vary significantly from year to year, such a list represents only a current estimate of future priorities.

Overall, dredging of recreation and low-use commercial harbors has been scheduled such that the impact on users is minimized. Channel condition surveys and user reports will be monitored in the year of execution so that shoaling rates and locations do not force the closure of channels to navigation traffic, thus reducing the impediment to any local industry or commerce.

We will also continue to evaluate how best to absorb the reduction below FY 1988 levels at recreation areas of completed projects. If our proposed user fee legislation is enacted we will request appropriation of any additional receipts to enhance the budgeted level of recreation area operation and maintenance.

OPERATION AND MAINTENANCE, GENERAL REDUCED AMOUNTS FOR RECREATION SITES AND LOW USE COMMERCIAL NAVIGATION DREDGING COMPARED TO FISCAL YEAR 1988 FUNDING LEVELS

State	Project	Reduction
		($1000)
AR	NORFORK LAKE	211
AR	NARROWS DAM-LAKE GREESON	247
CA	CHANNEL ISLANDS HARBOR CA	2,000
GA	WEST POINT DAM AND LAKE	159
GA	RICHARD B RUSSELL	164
KY	BARKLEY DAM AND LAKE BARKLEY	4,000
LA	OUACHITA & BLACK RIVERS AR & LA	233
MD	FISHING BAY	1,184
NJ	COHANSEY RIVER	1,545
NY	LONG ISLAND INTRACOASTAL WATERWAY	1,355
OK	FORT GIBSON LAKE	184
OK	EUFAULA LAKE	203
OK	TENKILLER FERRY LAKE	178
PA	RAYSTOWN LAKE PA	228
TN	J PERCY PRIEST DAM AND RESERVOIR	182
	Total	12,072

OPERATION AND MAINTENANCE PROJECTS CURTAILED

Senator JOHNSTON. Provide for the record a list of those O&M projects curtailed or deferred due to policy reasons, including the amount needed to provide an optimum level of maintenance.

General HEIBERG. The only O&M projects which we have curtailed or deferred due to policy reasons are those low-priority commercial and recreation projects which I will furnish for the record in response to one of your earlier questions plus those in caretaker status and the FY 1988 items on which we did not take action. I will furnish a listing on the latter two categories for the record.

(The information follows:)

TABLE I

FY 1988 PROJECTS NOT BEING MAINTAINED

Project	Cost of Full O&M ($000)
Little Falls, MN	$800.0
New York State Barge Canal, NY	10,000.0
Dogue Creek, VA	(1)

TABLE II

FY 1989 PROJECTS IN CARETAKER STATUS

Project	Cost of Full O&M ($000)
Pearl River, MS	$1,500.0
Savannah River below Augusta, GA	3,261.0
Atlantic Intracoastal Waterway, VA (Dismal Swamp Route)	160.0
Inland Route, WI	62.0
Fox River, WI	5,086.0
Cross Florida Barge Canal, FL (Lock Operations)	236.0

(1) Project was included in Senate Report 100-159. However, this is not an authorized Corps of Engineers project and funds cannot be expended.

CONSTRUCTION PRODUCTIVITY ADVANCEMENT RESEARCH

Senator JOHNSTON. A new program for construction productivity advancement is to be initiated in 1988 with reprogrammed funds. Could you explain the purpose and need for this program?

Mr. PAGE. The need for the program stems from the fact that levels of construction research and development spending over recent years, both by government and private industry, have been deficient. The result has been a loss of competitiveness and productivity by the U.S. construction industry, not only in this nation but abroad. This has further resulted in unnecessarily high costs for both public and private construction. Cost savings from increased productivity would accrue directly to the Corps of Engineers water resource construction program, as well as benefit the construction industry and nation in general.

Senator JOHNSTON. You propose to reprogram $300,000 to determine the feasibility and potential for a joint program with the private sector. Why does it take $300,000 to make this determination?

Mr. PAGE. This is a new program and a new approach to Corps research and development. New research and development programs require effort and funds to develop. This particular program involves not only the normal costs associated with such a research and development program but entails efforts to make the program widely known to industry, professional and industry associations, academia, and other government agencies. Construction Productivity Advancement Research has to be explained to these potential participants because without their participation there can be no program since cost sharing is an essential feature of the program. It takes considerable effort to do this.

Senator JOHNSTON. Are the funds to be reprogrammed from within the Research and Development budget? Will committee approval be required?

Mr. PAGE. The funds are to be reprogrammed from within the General Investigations Research and Development budget. We are desirous of working together with Congress on this proposal and toward that end, we have informed the committee of our plans to reprogram $300,000 from the seven program areas of the overall General Investigations Research and Development program.

Senator JOHNSTON. Provide for the record a detailed breakout of how the funds are to be used, including a table breaking down the request by object classification.

Mr. PAGE. The reprogrammed funds will be used to develop the details of the proposed program, including identification and description of technologies the Corps believes need improvement and technologies the Corps has under development on which industry may wish to join in a cost sharing effort; detailed procedures for program management; detailed briefings and briefing materials to describe the program to industry; preparation and printing of brochures and other written material to describe the program; preparation and distribution of advertisements and direct mail material describing the program and announcing meetings regarding the program; and preparation of responses to inquiries concerning the program. These activities require involvement of Corps research and development personnel, travel, printing and other direct and indirect costs which are shown in the following table by object classification.

Object Code	Object Classification	Amount ($000)
111	Full-time Permanent	$180
115	Other Personnel Compensation	10
121	Personnel Benefits, Civilian	8
210	Travel and Transportation	20
233	Communications, Utilities	10
240	Printing and Reproduction	12
250	Other Services*	55
260	Supplies and Materials	5
	Total	$300

*Contracts, printing of brochures, advertisements, conference facilities

Senator JOHNSTON. What level of funding is included in the FY 1989 budget to continue this program?

Mr. PAGE. We have included no funds for the Construction Productivity Advancement Research program in the FY 1989 budget request, pending identification of research needs and sources of non-Federal financing through joint efforts by the Corps of Engineers and industry, professional associations, academia, and other representatives. If these initial efforts are successful, we would anticipate advising this subcommittee and Congress at some later date of our plans to continue the effort within the total General Investigations resources proposed in the FY 1989 budget.

Senator JOHNSTON. Provide a funding profile for this activity for the next 5 years.

Mr. PAGE. It is not possible at this time to provide a funding profile over the next five years since we have not yet had the opportunity to interact with industry and other non-Federal representatives to determine if they will participate in the cost-shared Construction Productivity Advancement Research program and to what extent they may participate. We will be in a better position to make an estimate of such a funding profile after our initial efforts to inform industry and others of the Construction Productivity Advancement Research program are complete.

Senator JOHNSTON. This proposal appears to run counter to Administration efforts to have the private sector take over more of the activities performed by the federal government?

Mr. PAGE. In the area of technology transfer both Congress and the Administration support an active federal program to enhance productivity in U.S. industry. Through the Stevenson-Wydler Technology Innovation Act of 1980, Public Law 96-480, as amended by Technology Transfer Act of 1986, Public Law 99-502, Congress has authorized cooperative efforts between the private sector and the Federal Government to meet these needs. The legislation recognized that: no comprehensive national policy exists to enhance technological innovation for commercial and public purposes. There is a need for such a policy, including a strong national policy supporting domestic technology transfer and utilization of the science and technology resources of the Federal Government. P.L. 96-480, as amended by P.L. 99-502, Section 2.8.

In his April 10, 1987 statement accompany Executive Order 12591, implementing the Act, President Reagan stated: I believe a vigorous science and technology enterprise involving the private sector is essential to our economic and national security as we approach the 21st century.

The Corps of Engineers Construction Productivity Advancement Research Program is a comprehensive attempt to support the goals of the Act in the specific area of construction related technology. The Construction Productivity Advancement Research Program is designed to facilitate: technology transfer from our laboratories; and the utilization of the science and technology resources of the Corps of Engineers. Studies by the National Research Council, the Office of Technology Assessment, and others have shown that the construction industry has historically spent very little for research and development. The construction industry spends only four percent of sales on research and development which is less than any other mature industry spends. This low spending is a result of the low capitalization and small size of most construction firms.

The lack of research and development in the construction industry has resulted in falling productivity, higher construction costs, and a loss of competitiveness by the U.S. construction industry both at home and abroad. An active federal program, as envisioned by Congress and the Administration, is necessary to reverse these problems by helping the private sector to help itself. The Corps Construction Productivity Advancement Research program consists of the appropriate elements to facilitate this goal.

Senator JOHNSTON. Why should federal resources be used to get the private sector to invest in research and development?

Mr. PAGE. The 1983 report of the White House Science Council's Federal Laboratory Review Panel states: The ultimate purpose of federal support for research and development is to develop the science and technology base needed for a strong national defense, for the health and well-being of U.S. citizens, and for a healthy U.S. economy. Federal laboratories should recognize that they are an important part of the partnership with universities and industry in meeting this goal. A strong cooperative relationship must exist between federal laboratories, universities, industry and other users of the laboratories research results.

The Construction Productivity Advancement Research Program is designed to change the traditional patterns of construction related research and development spending in the U.S. by creating a cooperative relationship between the Corps laboratories and the construction industry. The Construction Productivity Advancement Research Program will use the existing authorities of the Stevenson-Wydler Technology Innovation Act of 1980, Public Law 96-480, as amended by Technology Transfer Act of 1986, to establish this Corps-Construction industry research and development partnership. In these Acts Congress realized the necessity of utilizing federal resources to enhance and stimulate private sector research and development.

In summary, the dedication of federal resources to the Construction Productivity Advancement Research Program is a realization of stated Congressional and Administration policy to support the private sector through collaborative effects to develop technology.

Senator JOHNSTON. Would not the long-term continuity and success of an initiative of this type be better assured if it were founded first on the commitment of the private sector through existing industry-wide associations?

Mr. PAGE. We expect to work closely with all parts of the construction industry and certainly would include efforts with industry-wide associations where possible. It should be noted though, that industry-wide association research and development spending has been no better than private firm spending which has led, in part, to the present situation of low productivity. We plan for the Construction Productivity Advancement Research Program to develop cost-sharing partnership research and development efforts with all segments of the U.S. construction industry to include private firms, industry associations, professional societies, academia, and other governmental agencies, federal, state and local. We also plan to work closely with all these elements to identify the greatest construction research and development needs and most promising technological opportunities to meet these needs and provide improvements in construction productivity.

STATUS OF NEW CONSTRUCTION STARTS

Senator JOHNSTON. Last year the committee received testimony indicating that only 11 of some 70 projects in the FY 1985 Supplemental and FY 1987 bill, which had been approved as new construction starts in accordance with the new cost-sharing requirements, had actually been started. Could provide an updated status on those new starts?

Mr. PAGE. We have initiated construction on 45 of the 73 FY 1985 Supplemental and FY 1987 new construction starts discussed in last year's testimony. Furthermore, we are continuing our efforts to complete engineering and design and execute local cooperation agreements on 24 others and we have budgeted two of the remaining four projects for preconstruction engineering and design in FY 1989.

Senator JOHNSTON. To what do you attribute the delays in starting actual construction? Material provided at last year's hearing would indicate that policy differences account for a majority of the delay.

Mr. PAGE. Policy differences accounted for delays on only 11 of the 73 new construction starts as noted in last year's testimony. We should not overlook the fact that many of the projects included in the FY 1985 Supplemental and FY 1987 Appropriation Acts were not ready to start construction immediately after passage of the Acts and required additional engineering and design effort before we could get them underway. In addition, another major delaying factor was the time required to negotiate and execute local cooperation agreements with non-Federal sponsors.

Senator JOHNSTON. Could you work with the staff to develop a table to be included in the record which tracks all of the new starts funded to date?

Mr. PAGE. Yes, I will provide the requested table for the record.

FY 1985 SUPPLEMENTAL, FY 1987, AND FY 1988 CONSTRUCTION NEW STARTS

89S-030
25 MAR 88

NO	DIV	PROJECT	FY 89 BUD AMT $000	SCHED LCA EXCTN YR	SCHED CONST. START YR
FY 85 SUPPLEMENTAL NEW STARTS INITIATED OR COMPLETED					
1	NAD	ARDSLEY, NY	2,680	DONE	DONE
2	MRT	ATCHAFALAYA BASIN FLOODWAY SYSTEM, LA	11,700	DONE	DONE
3	NAD	BALTIMORE HARBOR AND CHANNELS, MD & VA (50-FT DEEPENING)	27,600	DONE	DONE
4	NAD	BARNEGAT INLET, NJ	7,800	DONE	DONE
5	NCD	BASSETT CREEK, MN	1,500	DONE	DONE
6	SWD	BOGGY CREEK, AUSTIN, TX	8,000	DONE	DONE
7	NPD	BONNEVILLE NAVIGATION LOCK, OR & WA	42,000	NOT REQD	DONE
8	SWD	CLEAR CREEK, TX	4,300	DONE	DONE
9	NAD	COWANESQUE LAKE, PA (MODIFICATION)	0	DONE	DONE
10	NCD	DES MOINES RECREATION RIVER AND GREENBELT, IA	750	DONE	DONE
11	NCD	ELLICOTT CREEK, NY	1,200	DONE	DONE
12	SPD	FAIRFIELD VICINITY STREAMS, CA	2,400	DONE	DONE
13	SWD	FREEPORT HARBOR, TX	11,300	DONE	DONE
14	ORD	GALLIPOLIS LOCKS AND DAM, WV & OH	60,000	NOT REQD	DONE
15	NCD	GENEVA-ON-THE-LAKE, OH	0	DONE	DONE
16	NED	JONESPORT HARBOR, ME	1,800	DONE	DONE
17	POD	KAHOMA STREAM, MAUI, HI	1,784	DONE	DONE
18	NAD	KILL VAN KULL AND NEWARK BAY CHANNEL, NY & NJ	54,300	DONE	DONE
19	NAD	LIBERTY STATE PARK LEVEE AND SEAWALL, NJ	4,778	DONE	DONE
20	SPD	LITTLE DELL LAKE, UT	7,800	DONE	DONE
21	LMV	MISSISSIPPI RIVER SHIP CHANNEL, GULF TO BATON ROUGE, LA	3,800	DONE	DONE
22	MRD	MISSOURI NATIONAL RECREATIONAL RIVER, NE & SD	75	DONE	DONE
23	SAD	MOBILE HARBOR, AL	9,685	DONE	DONE
24	NAD	MORICHES INLET, NY	1,225	DONE	DONE
25	NAD	NORFOLK HARBOR AND CHANNELS, VA (55-FT DEEPENING)	2,700	DONE	DONE
26	NCD	PORT ONTARIO, NY	0	DONE	DONE
27	NAD	RICHMOND, VA	11,100	DONE	DONE
28	SAD	SAVANNAH HARBOR, GA	5,760	DONE	DONE
29	SAD	TAMPA HARBOR BRANCH CHANNELS, FL	0	DONE	DONE
30	NCD	UPPER MISS RVR SYSTEM ENVIR MGMT PROGRAM, IL, IA, MO, MN, & WI	7,000	DONE	DONE
31	NAD	VIRGINIA BEACH STREAMS, CANAL NO. TWO, VA	757	DONE	DONE
32	SAD	WILLIAM BACON OLIVER LOCK AND DAM, AL	31,000	NOT REQD	DONE

FY 1985 SUPPLEMENTAL, FY 1987, AND FY 1988 CONSTRUCTION NEW STARTS

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NO	DIV	PROJECT	FY 89 BUD AMT $000	SCHED LCA EXCTN YR	SCHED CONST START YR
FY 85 SUPPLEMENTAL NEW STARTS NOT YET INITIATED					
1	SAD	DADE COUNTY, NORTH OF HAULOVER BEACH PARK, FL	0	DONE	FY 88
2	MRT	EIGHT MILE CREEK, AR	546	FY 90	FY 90
3	LMV	LOCK AND DAM 26, SECOND LOCK, IL & MO	13,000	NOT REQD	FY 89
4	SPD	MERCED COUNTY STREAMS, CA	4,000	DONE	FY 88
5	LMV	PEARL RIVER, ST. TAMMANY PARISH, LA	400	DONE	FY 90
6	SPD	SACRAMENTO RIVER DEEPWATER SHIP CHANNEL, CA	5,300	DONE	FY 88
FY 85 SUPPLEMENTAL NEW STARTS FUNDED FOR PRECONSTRUCTION ENGINEERING AND DESIGN (PED)					
1	SAD	GULFPORT HARBOR, MS	231	NOT SCHED	NOT SCHED
FY 87 NEW STARTS INITIATED OR COMPLETED					
1	NAD	DELAWARE RIVER VICINITY OF CAMDEN, NJ	0	DONE	DONE
2	SWD	FOUNTAIN CREEK AT PUEBLO, CO	2,700	DONE	DONE
3	SWD	FOURCHE BAYOU BASIN, LITTLE ROCK, AR	2,500	DONE	DONE
4	SWD	GREAT BEND, KS	3,500	DONE	DONE
5	SAD	JACKSONVILLE HARBOR, MILL COVE, FL	0	DONE	DONE
6	SWD	LAKE WICHITA, HOLLIDAY CREEK AT WICHITA FALLS, TX	7,500	DONE	DONE
7	NPD	MT. ST. HELENS SEDIMENT CONTROL, WA	21,500	DONE	DONE
8	SPD	PAJARO RIVER, CA	2,470	DONE	DONE
9	SPD	REDBANK AND FANCHER CREEK, CA	4,500	DONE	DONE
10	NCD	SOUTH FORK ZUMBRO RIVER AT ROCHESTER, MN	7,100	DONE	DONE
11	NCD	SOUTH QUINCY LEVEE AND DRAINAGE DISTRICT, IL	3,600	DONE	DONE
12	SAD	SOWASHEE CREEK, MS	5,400	DONE	DONE
13	SAD	THREEMILE CREEK, AL	4,500	DONE	DONE

FY 1985 SUPPLEMENTAL, FY 1987, AND FY 1988 CONSTRUCTION NEW STARTS

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NO	DIV	PROJECT	FY 89 BUD AMT $000	SCHED LCA EXCTN YR	SCHED CONST START YR
FY 87 NEW STARTS NOT YET INITIATED					
1	POD	AGANA RIVER, GU	1,840	FY 88	FY 88
2	SAD	BLACK WARRIOR AND TOMBIGBEE RIVERS, VICINITY OF JACKSON, AL	50	FY 90	FY 90
3	NAD	CAPE MAY INLET TO LOWER TOWNSHIP, NJ	1,000	FY 88	FY 88
4	SAD	CROSS FLORIDA BARGE CANAL (LAND ACQUISITION)	0	NOT AVAIL	NOT AVAIL
5	NAD	FRANCIS E. WALTER DAM, PA (MODIFICATION)	4,200	FY 88	FY 88
6	SWD	HALSTEAD, KS	1,800	FY 88	FY 88
7	SPD	OAKLAND HARBOR, CA	10,000	FY 88	FY 88
8	SWD	PARKER LAKE, OK	2,000	FY 88	FY 88
9	SAD	PONCE HARBOR, PR	0	FY 88	FY 88
10	NED	PORTSMOUTH HARBOR AND PISCATAQUA RIVER, NH & ME	6,900	FY 88	FY 88
11	NCD	RED ROCK DAM - LAKE RED ROCK, IA	0	NOT REQD	FY 88
12	NED	REVERE BEACH, MA	3,510	FY 88	FY 88
13	SPD	SAN LUIS REY RIVER, CA	6,200	FY 88	FY 88
14	NAD	TAMAQUA, PA	1,640	FY 88	FY 89
15	NED	TOWN BROOK, QUINCY AND BRAINTREE, MA	7,950	FY 88	FY 88
16	SAD	VILLAGE CREEK, AL	3,800	FY 88	FY 88
FY 87 NEW STARTS FUNDED FOR PRECONSTRUCTION ENGINEERING AND DESIGN (PED)					
1	SAD	MIAMI HARBOR (CLEANUP), FL	100	NOT SCHED	NOT SCHED
FY 87 NEW STARTS NOT SCHEDULED FOR CONSTRUCTION					
1	SAD	RANDLEMAN LAKE, NC	0	NOT SCHED	NOT SCHED
2	NCD	SILVER BAY HARBOR, MN	0	NOT SCHED	NOT SCHED

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NO	DIV	PROJECT	FY 89 BUD AMT $000	SCHED LCA EXCTN YR	SCHED CONST START YR
FY 88 NEW STARTS INITIATED OR COMPLETED					
1	SAD	CHARLESTON HARBOR, SC	7,000	DONE	DONE
FY 88 NEW STARTS NOT YET INITIATED					
1	SWD	ACEQUIAS IRRIGATION SYSTEM, NM	0	FY 88	FY 88
2	SWD	ALAMOGORDO, NM	7,400	FY 88	FY 88
3	NCD	CHASKA, MN	1,000	FY 88	FY 88
4	NCD	CLEVELAND HARBOR, OH	0	NOT AVAIL	NOT AVAIL
5	LMV	EAST ST LOUIS & VIC,IL	3,000	FY 89	FY 89
6	ORD	GRAYS LANDING, LOCK AND DAM 7, MONONGAHELA RIVER, PA	14,200	NOT REQD	FY 88
7	NCD	HANNIBAL, MO	1,000	FY 88	FY 89
8	SAD	MANATEE HARBOR, FL	5,000	FY 88	FY 88
9	ORD	MASSILLON, OH - WALNUT AND CHERRY STREET BRIDGES	0	FY 88	FY 88
10	SAD	MIAMI RIVER PARK, FL	0	FY 88	FY 88
11	SWD	MINGO CREEK, OK	6,200	DONE	FY 88
12	NCD	NORTH BRANCH CHICAGO RIVER, IL	4,000	FY 88	FY 88
13	SAD	OATES CREEK, RICHMOND COUNTY, GA	2,000	FY 88	FY 88
14	LMV	OUACHITA RIVER LEVEES (BAWCOMVILLE AREA), LA	900	FY 89	FY 89
15	NCD	PRESQUE ISLE PENINSULA, PA (PERMANENT)	4,000	FY 88	FY 88
16	SWD	PUERCO RIVER AT GALLUP, NM	3,100	FY 88	FY 88
17	NCD	RENO BEACH HOWARD FARMS, OH	1,610	FY 66	FY 88
18	SPD	RICHMOND HARBOR, CA	430	FY 89	FY 89
19	SWD	RIO GRANDE FLOODWAY, TRUTH OR CONSEQUENCES UNIT, NM	3,800	FY 88	FY 88
20	NPD	ST PAUL ISLAND HARBOR, AK	7,000	FY 88	FY 88
21	NCD	STATE ROAD AND EBNER COULEES, WI	6,400	FY 88	FY 88
22	NAD	TANGIER ISLAND, VA (SHORE PROTECTION)	2,576	FY 89	FY 89
23	MRD	WESTERLY CREEK, CO	5,100	FY 88	FY 89
24	SPD	WHITEWATER RIVER FLOODWARNING SYSTEM, CA	0	FY 88	FY 88

FY 1985 SUPPLEMENTAL, FY 1987, AND FY 1988 CONSTRUCTION NEW STARTS

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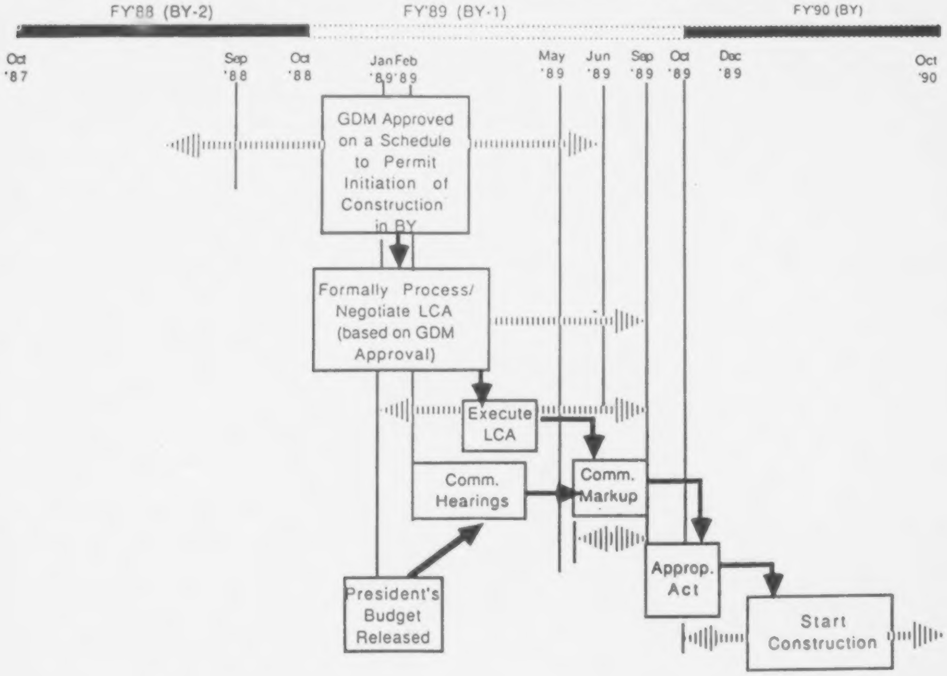
NO	DIV	PROJECT	FY 89 BUD AMT $000	SCHED LCA EXCTN YR	SCHED CONST START YR
FY 88 NEW STARTS FOR WHICH FY 88 FUNDS WILL BE USED TO PREPARE APPROPRIATE REPORTS ON WHICH A DECISION CAN BE MADE WHETHER OR NOT TO PROCEED WITH CONSTRUCTION					
1	ORD	CAMPGROUND LAKE, KY	0	NOT SCHED	NOT SCHED
2	ORD	GALLATIN COUNTY STREAMBANK EROSION, AREA 1, OHIO RIVER, IL	0	NOT SCHED	NOT SCHED
3	SAD	INDIAN RIVER COUNTY - VERO BEACH COMPONENT, FL	0	NOT SCHED	NOT SCHED
4	ORD	KANAWHA RIVER, CHARLESTON, WV (STREAMBANK EROSION PROTECTION)	0	NOT SCHED	NOT SCHED
5	ORD	KANAWHA RIVER, ST ALBANS, WV (STREAMBANK EROSION PROTECTION)	0	NOT SCHED	NOT SCHED
6	NCD	MUCK LEVEE,IL	0	NOT SCHED	NOT SCHED
7	ORD	SALYERSVILLE, KY	0	NOT SCHED	NOT SCHED
8	SWD	COCHITI PUEBLO, NM	0	NOT REQD	NOT REQD
FY 88 NEW STARTS NOT SCHEDULED FOR CONSTRUCTION					
1	SAD	KISSIMMEE RIVER, FL	0	NOT SCHED	NOT SCHED
2	NCD	MAUMEE BAY STATE PARK, OH	0	NOT SCHED	NOT SCHED
3	NED	ST. JOHN RIVER BASIN, ME	0	NOT SCHED	NOT SCHED
4	NCD	WATERLOO, IA, BRIDGES	0	NOT SCHED	NOT SCHED

EXECUTION OF LOCAL COST SHARING AGREEMENTS

Senator JOHNSTON. The Conferees on the 1988 Energy and Water bill stated that local cost sharing agreements should be executed before the end of the preconstruction engineering and design stage. What actions have been taken to carry out this direction?

Mr. PAGE. To the extent possible, we intend to follow the Conference Committee guidance. We will focus our attention on projects that are nearing the completion of preconstruction engineering and design (PED). We will develop and process LCA's on projects which will be ready for construction in the budget year. Generally, this would mean the GDM would be complete by the time the President makes his budget submission to Congress; however, there could be exceptions. With an approved GDM, execution of the LCA could occur once the project has been budgeted as a new construction start, that is, after release of the President's budget, and prior to the appropriation of funds by the Congress, wherever possible. Our goal is to have all LCA's signed or ready to be signed when the initial construction funds are appropriated. On other potential new start candidates that meet the budget criteria, but have not been included in the President's budget, LCA's would not be executed until after either being added by Congress or specifically budgeted in a future fiscal year. The following flow diagram reflects the typical time frame between processing and execution of LCA's that we are considering commencing with Fiscal Year 1990.

Typical Construction Funding vs. LCA Execution Process


FY'88 (BY-2)
FY'89 (BY-1)
FY'90 (BY)
Oct '87
Sep '88
Oct '88
Jan Feb '89 '89
May '89
Jun '89
Sep '89
Oct '89
Dec '89
Oct '90
GDM Approved on a Schedule to Permit Initiation of Construction in BY
Formally Process/ Negotiate LCA (based on GDM Approval)
Execute LCA
Comm. Hearings
Comm. Markup
President's Budget Released
Approp. Act
Start Construction

Senator JOHNSTON. In your opinion, is having a signed LCA before completion of PED too great an expectation?

Mr. PAGE. Under the process I have just outlined, the actual LCA signing would occur during the time frame between release of the President's budget and prior to the appropriation of funds by the Congress. We would not be prepared to execute LCA's prior to this because of the potential for policy and project scope changes that would be more likely to occur as the time frame is increased between LCA execution and project construction. We are looking to have signed LCA's at the completion of PED so that we may have an orderly progression from PED into construction. Execution of an LCA at this time would benefit all parties since it would reflect the project's latest estimate of costs and benefits, thereby triggering the arrangement of financing mechanisms for local sponsors while providing the Congress with the most up to date cost data to facilitate the appropriation of construction funds.

Senator JOHNSTON. In your judgment, what is the most appropriate point at which a binding cost sharing contract should be in hand? Should this be criteria for inclusion in the budget?

Mr. PAGE. Clearly the time to have a binding LCA would be after release of the President's budget and prior to the appropriation of funds by Congress. In this manner, the Congress has a clear picture that a local sponsor is ready and willing to cost share in the construction of a project. An executed LCA at this time would also allow sponsors the opportunity to complete financing arrangements and potentially advance the initiation of construction to the first or second quarter of the fiscal year. Heretofore, LCA execution has not occurred until after the appropriation of construction funds, pushing the initiation of construction out to the third or fourth quarter, or in some cases, into the next fiscal year. With respect to your question on whether an executed LCA should be made a part of the budget criteria, I feel that would not be appropriate; however, it would be incumbent on us to execute LCA's prior to your completion of mark-up in cases where planning has progressed sufficiently to have an approved GDM and a fully negotiated LCA.

Senator JOHNSTON. How many of the six New Construction Starts budgeted for 1989 meet this requirement.

Mr. PAGE. Sir, at this time none of the six budgeted FY 89 New Starts have executed LCA's. We are, however, actively developing and negotiating LCA's on all six. On one project in particular, Sheyenne River, North Dakota, we are reviewing the draft LCA on the first element of construction here in Washington and I expect that it will be ready to be signed within the next 30 to 60 days.

FISCAL YEAR 1988 FUNDING ALLOCATIONS

Senator JOHNSTON: Mr. Secretary, the subcommittee just recently received your report on the allocations and changes to items in the Energy and Water Appropriations bill for 1988.

That report, in a few instances, indicates that the Corps of Engineers has been directed not to proceed on certain items contrary to the action and intent of Congress.

How do you explain and justify this action particularly when:

1) the Energy and Water bill complied with the Budget Summit Agreement and the spending and outlay levels set by OMB, and
2) the items have been authorized by an Act signed by the President.

Mr. PAGE: We are proceeding, for the most part, with the allocations and language contained in the 1988 Energy and Water Development Appropriation Act and the accompanying Conference Report. For example, there were over 60 studies and projects directed to be undertaken in Act language, and we have initiated work on all of these items. In addition, there were over 200 studies and projects added in the Report language, of which we have complied with more than 160.

We are acting in accord with the guidance provided in the Report to the extent possible within the Executive Branch policy framework and the desire to carry out a nationally consistent program. As a result, there are instances where we have not proceeded with the language and/or allocations contained in the Conference Report.

Senator JOHNSTON: Why cause all the pain and anguish-up here when in the end the items will probably be put into the Act and the Corps will be forced to undertake the projects? The only result from this approach is a higher cost to the government, reduced flexibility for the Corps to manage its program, and a lot of time wasted writing letters and trying to explain why you have taken this action.

Mr. PAGE: We have distributed funds to the field activities generally as Congress proposed. However, current budgetary constraints and competing priorities preclude funding of every study and project which is included in the Act's Conference Report.

APPLICATION OF SAVINGS AND SLIPPAGE

Senator JOHNSTON: Section 503 of the 1988 Energy and Water Bill requires that any reduction for savings and slippage or a general reduction be applied across the board and proportionately. Can you explain why many activities under Remaining Items show allocations for 1988 at the budgeted level?

Mr. PAGE: For the Construction, General appropriation, the only item which shows an allocation for Fiscal Year 1988 at the budgeted level is Employees Compensation. The budgeted amount reflected the total costs of benefits and other payments made from the Employees Compensation Fund during the period July 1, 1985 through June 30, 1986, which were billed to the U.S. Army Corps of Engineers by the Department of Labor for reimbursement. Although we did apply savings and slippage proportionately to this item, as well as to remaining items under the Operation and Maintenance, General appropriation, in accordance with Section 503 of the Energy and Water Development Appropriation Act, 1988, we reprogrammed sufficient funds to this item from surplus funds elsewhere with no adverse effect to other activities under the general guidelines for reprogramming actions.

For the General Investigations, Regulatory Functions, Flood Control and Coastal Emergencies, and General Expenses accounts, there was no savings and slippage or general reductions so the Remaining Items allocations were not less than the budget amounts.

Senator JOHNSTON: Are there any activities where the allocations exceed the amounts envisioned in the Energy and Water Appropriation Bill? If so, provide a list for the record along with a brief explanation of why.

Mr. PAGE: There are no activities for Remaining Items under the Construction, General, and Operation and Maintenance, General, appropriations where the allocations for Fiscal Year 1988 exceed the amount specified in the Conference Report which accompained the Energy and Water Development Appropriation Act, 1988.

Under the General Investigations appropriation, the Conference agreement on the Fiscal Year 1988 Energy and Water Development Appropriations Act for coordination studies with other agencies included $600,000 for Section 22 studies in the States of Minnesota and North Dakota. The effect of this guidance was to increase the amount allocated for these two states by $400,000 without increasing the amount for coordination studies as a whole. The additional amount was provided from the funds that had originally been requested for the review for deauthorizatiton program. Due to the new deauthorization procedures in the Water Resources Development Act of 1986, these funds are not required.

GENERAL REGULATORY FUNCTIONS

Senator JOHNSTON. Last year the Congress created a new separate account for General Regulatory Function in order to better review the growth and cost of these programs. Further, because of budgetary constraints, only $55,262,000 was appropriated compared to the budget request of $60,000,000. Give the committee a brief status report on the program.

General HEIBERG. While the reform initiatives which began in 1982 have improved the Corps efficiency, other factors have expanded and complicated the regulatory program. We have been receiving about 14,000 applications annually for individual permits for the last five years but applications are, on average, more difficult than they were a few years ago since the most attractive permit sites have been developed. Other workload factors have increased; activities covered by regional permits have grown from 10,000 five years ago to 22,000 in FY 1987 and reported violations have grown from 4,300 three years ago to 6,000 last year. In addition, the program's jurisdiction was expanded into isolated waters by an EPA decision in 1985. The recent revisions to our 404(q) agreements with the other Federal agencies on coordination of permit applications have actually complicated the process. As a result of these program changes, our resources in the last two years have not kept pace with workload demands. Because of declining dollars we went from about 910 personnel spaces in FY 1985 to 870 in FY 1987.

Senator JOHNSTON. Provide a table for the record which shows the budget request, congressional appropriation, and actual expenditures by fiscal year from inception through 1987.

General HEIBERG. The table below shows the regulatory budget over the last 15 years, from the inception of the expanded 404 program in 1975. The regulatory program has been in existence since 1890.

Corps of Engineers Regulatory Program Budget History
(Dollars in Millions)

Fiscal Year	Budget Request	Allocation/ Appropriation	Expenditures
1975	9.3	9.3	16.2
1976	20.0 *	20.0	21.2
1976T	5.5	5.5	5.8
1977	35.8 *	35.8	30.0
1978	41.5 *	41.5	36.9
1979	43.4	43.4	43.2
1980	40.0	40.0	40.8
1981	41.9	41.9	43.5
1982	48.9	48.9	45.8
1983	47.0	47.0	46.0
1984	49.5	49.5	50.9
1985	49.5	49.5	53.8
1986	51.0	49.5	57.3
1987	52.9	55.0 **	56.1
1988	60.0 ***	55.3	
1989	60.4 ****		

Prior to FY 1988, the Regulatory budget was included as part of the Operation and Maintenance, General, program.

* FY's 76, 77 and 78 increases were for phased-in expansion of Section 404 programs to all waters of the United States in accordance with Court order of March 1975.

** Includes $5 million reprogramming adjustment with committee notification.

*** Amended Budget.

**** First Year as Separate Budget Request.

Senator JOHNSTON. What specific actions has the Corps taken to identify and control cost within the regulatory program?

General HEIBERG. We have recently implemented more detailed accounting procedures to better control the use of regulatory funds. Districts have also been given additional guidance on how they may use their funds. In addition, we have been working to improve cost management of environmental impact statements and to further insure they are done only when necessary. We recently convened a task force to develop some specific program revisions for cost savings through work reduction. Areas for cost savings we identified include having applicants handle more of the costs of their jurisdictional determination, returning more of the enforcement program to EPA, revising the inter-agency 404(q) agreements, expanding the nationwide permit program, having permittees verify permit compliance, and reducing the length and cost of public notices. We also intend to provide a more consistent and uniform distribution of resources to our 38 field offices in current and future budgets.

Senator JOHNSTON. What has been done to establish effective auditing and cost accounting procedures which meet standards acceptable to GAO?

General HEIBERG. For the new regulatory appropriation we have established five accounting categories for management of the program. These categories, which are consistent with GAO standards are Permit Evaluation, Enforcement, Studies, Other Navigation Regulations, and Environmental Impact Statements (EISs). Appropriated funds are allotted to districts in each of these categories; districts will report to us monthly on their expenditures in these categories. Individual studies and EISs will be tracked by headquarters to ensure national consistency in the judicious use of funds. In addition, we have developed new guidance on how districts may use their resources.

Senator JOHNSTON. What is the current status of the Corps efforts to submit a plan to recover all regulatory expenses

General HEIBERG. The plan will be submitted to the Assistant Secretary of the Army for Civil Works on March 15 for his review.

Senator JOHNSTON. What is the schedule for actually submitting the plan?

General HEIBERG. I believe the Assistant Secretary expects to have it ready to submit to the committees by April 15.

Senator JOHNSTON. Has the appropriation of only $55,262,000 for 1988 had any unacceptable adverse impacts on the General Regulatory Functions?

General HEIBERG. The immediate impact on the program is that we have been unable to fill some vacancies, including vacancies for personnel spaces shifted from other Corps programs to handle the regulatory workload. In the past, as part of the O&M appropriation, we could transfer funds from projects that experienced some savings or slippage. In addition, we have reduced contracting and cut back on important support expenses such as travel to permit sites and support from other Corps programs. With an abbreviated staff, workload pressures can cause delays for the regulated public, and there is increased potential for flawed decision making and litigation. Our application backlog is currently over 7,000, 40 percent higher than a year ago.

Senator JOHNSTON. Has the average processing time been adversely impacted?

General HEIBERG. Average time to review applications has increased. Our latest data from the first quarter FY 1988, showed that only 45 percent of all applications were given a decision within 60 days vs. 52 percent a year ago and 57 percent two years ago. The overall average is about 80 days per application vs. 72 days in FY 1986.

Senator JOHNSTON. Typically, how many permits does the Corps receive annually and how many of those have a financial benefit to the applicant or involve the sale of goods or services?

General HEIBERG. The Corps has received about 14,000 permit applications each year for the last several years. Many permits to individuals provide some financial enhancement as in the form of protecting property or raising property values. We estimate that commercial applicants represent from one fourth to one third of the total. In addition, around 10 percent of all applicants are State or Federal agencies.

Senator JOHNSTON. Explain the nature of the "increasing pressure to provide improved service to the public" referred to in the justification material.

General HEIBERG. Delays in providing decisions on permit applications have increased the number of complaints to the Corps in the last two years. Although there are always some delays beyond Corps control, the number of decisions delayed because of inadequate resources has clearly affected the regulated public. The Northeastern offices in particular have had difficulty keeping up with their workload. Phone call complaints and letters from private individuals, companies and government agencies have all increased. Members of Congress frequently write to the Corps on behalf of their constituents about such delays. Delays are costly and frustrating for both builders and private individuals.

Senator JOHNSTON. Is it from the public or private, commercial or non-commercial, etc?

General HEIBERG. All of these have complained. In the State of Maryland for example, local, state and Federal officials have complained because construction projects such as highways have been delayed. Most of the Congressmen and Senators in Maryland have written to the Corps on this matter. Recently the Maryland State Legislature sponsored a seminar for home builders who have become frustrated over the protracted regulatory process and want help in expediting their applications. I might add that there are also pressures from the environmental community to ensure there are adequate ecological controls in our decision making.

Senator JOHNSTON. Specifically, what new responsibilities have been added over the past year or two which have increased the cost of the regulatory program?

General HEIBERG. The most significant new responsibility was the 1985 jurisdiction expansion to isolated waters. The addition of isolated waters indirectly resulted in over 10,000 site visits for jurisdiction determinations last year. A few years ago jurisdictional determinations were not a large workload factor. In addition, the new requirements for notification and intense review on some nationwide permits has added new work. Since FY 1985 we have also been operating under new 404(q) coordination agreements with other Federal agencies which have added some steps to the coordination process. There is also an increasing emphasis on mitigation; the Congress has directed the Corps and EPA to develop a joint mitigation policy. Congress also added new work by providing the Corps a new administrative fine authority for permit non-compliance. Finally, recent court decisions have resulted in additional tasks and requirements for the Corps.

Senator JOHNSTON. From a policy point of view, is there any difference in applying a cost recovery program for General Regulatory Function of the Corps as it is to other Federal regulatory activities such as FERC, NRC, etc?

General HEIBERG. The activities regulated by the Corps of Engineers program are considerably more varied than those regulated by other Federal agencies. Those agencies usually have a specific charge, i.e., the Nuclear Regulatory Commission regulates nuclear power plants, the FERC regulates other power generating facilities, the FAA regulates airlines. The Corps regulates construction activities with a wide variety of purposes. The policy issues that the Corps must deal with can be more complex since the issues are more numerous. A fee system for the Corps would likely be more complex.

INTERAGENCY RESOURCE DEVELOPMENT

Senator JOHNSTON. The budget justification for 1989 includes a new $1,000,000 request to support interagency water resources development. This appears to be mainly related to activities associated with working out new cost-sharing agreements. How have these activities been funded previously in light of the fact that the Corps has been engaged in these types of activities over the past several years?

General HATCH. The activities covered by the request for Interagency Water Resources Development include more than working out cost sharing agreements. The $1,000,000 will provide funding for meetings and other coordination with cities, counties and states on their water resource problems prior to budgeting for a study and includes activities such as determining whether the Corps has a program applicable to the problem, discussions of non-Federal responsibilities such as cost sharing, and obtaining an indication of their interest in participating in a future study. The meetings and coordination do not always result in a budgeted study. Historically, such costs were an overhead charge borne by all studies. With the advent of cost sharing we recognized that it would not be proper to have a sponsor share in an overhead cost not related to his project.

Senator JOHNSTON. Can you provide additional documentation which supports this $1,000,000 request?

General HATCH. We have not made a detailed study of the costs of these activities, however we feel certain that they exceed the amount requested, and that the $1,000,000 is a conservative figure. As a years experience with this new account we will revise future requests to reflect actual charges.

SPECIAL INVESTIGATIONS

Senator JOHNSTON. The budget request for Special Investigations for fiscal 1988 was $3,650,000 and the FY 1989 request is for $4,500,000. This is a 23 percent increase over last year's request. What is the planned allocation for this activity in 1988?

Mr. PAGE. The planned allocation for the Special Investigations activities in fiscal year 1988 is approximately $400,000 for review of preliminary permit and license applications for non-Federal hydroelectric power development either at or affecting Corps water resources projects and $3,250,000 for special investigations and reports prepared pursuant to Congressional and other requests from outside the Corps and similar work of detailed scope specifically authorized by the Chief of Engineers.

Senator JOHNSTON. If more than the budget request, how will the funds be used?

Mr. PAGE. The amounts budgeted and appropriated for Special Investigations for Fiscal Year 1988 are the same.

Senator JOHNSTON. What would be the impact if the activity was frozen at the 1988 appropriated level and do you believe that a freeze level would result in an acceptable adverse impact?

Mr. PAGE. If the Special Investigations activities for FY 1989 were frozen at the FY 1988 appropriation level of $3,650,000 most certainly a number of requests for special investigations and reports will have to go unanswered. If the freeze went into effect, we would have tightened even further the prioritization on requests upon which we can act. While I believe the impact would be acceptable, I am not sure it would be viewed as acceptable by those whose requests go unanswered.

FLOOD PLAIN MANAGEMENT SERVICES

Senator JOHNSTON. The Flood Plain Management Services program continues to grow - just 3 years ago the program was funded at $6,800,000 and this was the average annual funding level between 1982-1986. Now, the FY 1989 budget request is $10,000,000. Briefly, what accounts for this continued program growth?

Mr. PAGE. Increasing use and development in the flood plains of the United States continue to increase demand for the flood hazard information, technical services, and planning guidance provided under the Flood Plain Management Services Program. We have tried to maintain a reasonable response capability based on a frugal balance between the growing demand for services and the level of Program funding as requested in the President's Budget.

Senator JOHNSTON. What efforts are being taken to hold the costs and growth of this program to a minimum?

Mr. PAGE. We are constantly seeking ways to minimize the cost and increase the productivity of this Program. One way has been to respond to more requests where we already have basic data on hand. Another way has been to undertake the more extensive and costly studies only when they have a very high potential for successfully avoiding significant unwise development in the flood plain. As a result, we have reduced the average cost of our responses from about $150 per response in 1982 to about $100 per response in 1986. Growth in the Program, however, is an entirely different issue. It represents an increasing willingness by the non-Federal public and private sectors to seek out and use our assistance to avoid the flood hazard. This not only helps to avoid future losses to life and property but also reduces the need for costly Federal flood control works as well as the demand for other flood-related Federal services such as providing disaster assistance during and following floods. In this sense, growth in the program may represent a reduction in demand for future Federal expenditures.

Senator JOHNSTON. How much of this funding has historically gone to support non-Federal requirements?

Mr. PAGE. On an average, around 80% of the Program funds have been used for non-Federal requirements.

Senator JOHNSTON. The justification for this item talks about the backlog of requests, yet the justification data for 1988 shows 82,000 requests compared to 77,000 indicated in this year's justification. How do you explain this apparent discrepancy?

Mr. PAGE. The numbers shown in the justification data are responses to requests. They represent program responsiveness rather than backlog. Because of the lower level of funding, the number of responses were less in 1987 than in 1986. This increased our current backlog.

Senator JOHNSTON: The justification material indicates "the growing number of high priority demands...". Could you be more specific? Provide for the record a list of specific high priority requests made during 1987 and to date in 1988.

Mr. PAGE: To qualify as a high priority demand a request must involve either a potential for loss of life, or property of relatively high value, or the requestor must indicate a great urgency and need. During 1987 and to date in 1988 we have provided several thousand responses to high priority requests. I will provide a partial list showing examples of those requests. (The information follows:)

HIGH PRIORITY REQUESTS

REQUESTOR	TOPIC OF REQUEST
St. Tammany Parish, Louisiana	Conduct flood hazard analysis and provide planning guidance to the Department of Public Works on proposed residential development along the Little Boguefalaya River.
City of Roanoke, Virginia	Assist in evaluating several flood-proofing and flood-reduction proposals for an industry on Tinker Creek that had incurred $50 million in flood damages during the 1985 flood.
State of New Hampshire	Analyze the effectiveness of the state's flood control system for the Merrimack River basin relative to operations during the 1987 floods.
Town of Carrboro, North Carolina	Develop flood-proofing and flood-reduction proposals for an apartment complex and several single family housing units along Toms Creek that floods every 2 or 3 years.
State of Vermont	Perform dam break analysis studies for dams of immediate concern to the state and assist in the development of state action plans to be used in case of failure.
City of Stanfield, Oregon	Provide flood hazard analysis and develop city-wide comprehensive flood plain management plan.
U. S. Environmental Protection Agency	Develop flood information as a basis for designing new sites and expansions to existing wastewater treatment plants for numerous cities and counties throughout the Nation.
State of West Virginia	Provide flood hazard evaluations and planning guidance on locations for constructing nursing homes.
City of Plymouth, Indiana	Perform flood hazard analysis and provide planning guidance and assistance to city officials in developing alternative plans to mitigate future flood losses.
Clay County, Florida	Provide assistance in the development of a flood warning and evacuation plan for the Middleburg area in the Black Creek watershed.
City of Mullins, South Carolina	Analyze the impact on the floodway from filling the flood plain for development of a mobile home park.
Lee County, Florida	Provide guidance relative to the location and design of emergency shelters for hurricane mitigation.

HIGH PRIORITY REQUESTS

REQUESTOR	TOPIC OF REQUESTS
State of Mississippi	Provide flood hazard analysis and planning guidance to city officials of Starkville, Mississippi to address proposed development along Springers Branch.
City of South Roxana, Illinois	Provide assistance and guidance to city planners for prudent use of flood plains in the location and design of an industrial park development.
U.S. Postal Service	Provide flood hazard evaluations on numerous construction sites for proposed new postal facilities.
State of Michigan	Provide flood hazard analysis at 60 identified hazardous waste sites.
U.S. Department of Housing and Urban Development	Provide flood hazard analysis at various potential construction sites and guidance as to the design of housing for elderly citizens in McKean County, Pennsylvania.
Hampton Township, Pennsylvania	Provide flood hazard analysis and guidance on the location and design of a day care center along Crouse Run. (A Presidentially declared disaster area in 1986).
State of Michigan	Provide guidance on the design, construction, and maintenance of levees for agricultural lands.
Yellville, Arkansas	Provide flood hazard analysis and planning guidance concerning the design of a hospital-nursing home facility along Town Branch.
State of Minnesota	Assist the state and the City of Elba to improve flood forecasting, warning systems and emergency prepardeness plans.
U.S. Bureau of Indian Affairs/ State of Arizona	Provide flood plain delineations and develop flood hazard mitigation plans for the Gila River Indian Community in Pinal County, Arizona.
City of Omaha, Nebraska	Provide flood hazard information and planning guidance to assist city officials in evaluating the site selection of a multi-million dollar residential/commercial development along the floodway fringe.
State of North Dakota	Evaluate effects of proposed Grand Forks dam on the Red River of the North's flood stages, floodway, and floodplain.
City of Lake Worth, Texas	Provide flood hazard analysis on the location of a new high school along a tributary of the Trinity River.

Senator JOHNSTON: Provide for the record a table which tracks the total number of requests, the number responded to, and the backlog for the last 5 years of record. The tabluation should be broken out by Federal, public, and private.

Mr. PAGE: I will provide the table you requested.
(The information follows:)

BACKLOG OF REQUESTS

FY	SOURCE	TOTAL REQUESTS*	TOTAL RESPONSES	BACKLOG
83	Federal	11,600	11,500	100
	Public	15,300	13,500	1,800
	Private	29,200	29,100	100
	Total	56,100	54,100	2,000
84	Federal	13,200	13,000	200
	Public	17,000	15,100	1,900
	Private	30,900	30,100	800
	Total	61,100	58,200	2,900
85	Federal	14,100	13,800	300
	Public	18,000	15,900	2,100
	Private	33,200	32,300	900
	Total	65,300	62,000	3,300
86	Federal	8,700	8,400	300
	Public	11,800	9,300	2,500
	Private	64,700	64,600	100
	Total	85,200	82,300	2,900
87	Federal	8,100	7,100	1,000
	Public	13,400	7,900	5,500
	Private	62,900	62,400	500
	Total	84,400	77,400	7,000

* NOTE: These numbers include the backlog from the previous year.

INTERNATIONAL WATER STUDIES

Senator JOHNSTON. Last year, an additional $1,500,000 was provided to initiate a study on methods of alleviating adverse consequences of fluctuating water levels in the Great Lakes - St. Lawrence River Basin. Bring the Committee up to date on the Corps work, including milestones and completion schedule.

General HATCH. The drafting of the Plan of Study was essentially completed in December 1987. This represented the first major milestone of the study concerning the Reference on fluctuating water levels in the Great Lakes - St. Lawrence River Basin. The study plan breaks the Reference effort into two phases including a framework analysis of a wide range of damage reduction measures in Phase I and a detailed evaluation of selected measures in Phase II. The major milestones for these efforts has the Phase I Report scheduled to be forwarded to the International Joint Commission (IJC) in May 1989 and the Phase II Report scheduled to be forwarded to the IJC in September 1991.

Senator JOHNSTON. What is the total cost of this effort expected to be and what is the projected funding profile by fiscal year through completion?

General HATCH. The total cost of the two-phase study will vary depending on the number and type of measures selected in Phase I for detailed study in Phase II. Categories of measures include: structural, non-structural, legislative, policy, and information. At this time, the mix of measures to be selected for detailed study in Phase II has not been determined. If, for example, there are more structural measures and fewer information measures the cost of Phase II would be relatively higher due to the level of detail necessary to evaluate and compare the measures. The cost estimate of Phase I is $4,200,000. The cost of Phase II is estimated to range between $3,500,000 and $5,000,000. These estimates include U.S, IJC and Canadian efforts. The Corps of Engineers needs for this study for FY88 and FY89 are $1,500,000 for each year. The needs for FY90 and FY91 have not yet been defined, again, this is due to the fact that Phase II has not been fully defined.

Senator JOHNSTON. Is Canada participating in this effort? If so, briefly discuss the Canadian role.

General HATCH. Canada is participating actively in the Reference study through the lead role of Environment Canada and in the continuing participation of the Canadian citizens on the IJC staff. The study management is broken down into several governance levels, each of which has equal U.S. and Canadian representation. Much of the Canadian daily effort is being provided through agency staffing of study elements within Environment Canada. Specific requests to the Canadian Treasury Board are being introduced on or about 1 April 1988 for supporting funds. For U.S. and Canadian planning purposes, the Canadian-U.S. cost sharing is considered to be 50%-50%.

Senator JOHNSTON. How much is Canada expected to spend on this study?

General HATCH. The Canadians consider themselves equal partners in the study and expect to share 50%-50% in the combined study costs with the U.S.

Senator JOHNSTON. Are the expected benefits mainly directed at the U.S. or will Canada derive some?

General HATCH. For planning and management purposes, the study is expected to have equal benefit to both countries. The benefits in the form of structural, non-structural, legislative, and policy alternatives will benefit both countries to the extent that alternatives are designed to alleviate fluctuating water levels and related problems.

SCIENTIFIC AND TECHNICAL INFORMATION CENTERS

Senator JOHNSTON. The budget includes $130,000 to support Scientific and Technical Information Centers within the Corps' Civil Works program. Discuss this program in more detail, particularly the direct benefits to the Civil Works program and why, when it appears that the Department of Defense is the principal beneficiary, this program is not funded with the Department of Defense resources.

Mr. PAGE. The Waterways Experiment Station operates four scientific and technical information centers. A brief summary of the functions of these centers follows:

Soil Mechanics Information and Analysis Center

This center serves the technical areas of soil mechanics, foundations, engineering geology, seismology, and geophysics. The first three have primarily Civil Works applications. It responds to requests for literature searches, locates experts and provides letter reports on special problems to Corps of Engineers District and Division offices and provides direct support to researchers at the Waterways Experiment Station who carry out the Civil Works research.

The Coastal Engineering Information Analysis Center

This center archives information including reports, wave data, Littoral Environment Observation data, coastal photographs and slides, and disseminates information in response to requests. This information is used extensively as a resource for planning and design of civil works projects within the Corps of Engineers, and as an information resource for coastal research and development within the Corps of Engineers. Also, a significant number of requests are received from non-Department of Defense government agencies, including state and local agencies, and from the private sector. Only a small number of requests are received from the Department of Defense activities outside the Corps of Engineers.

The Concrete Technology Information Analysis Center

This center's mission is to collect, analyze, evaluate, and disseminate information in the broad field of concrete technology." It is authorized to respond to queries, prepare state-of-the-art reports and bibliographies, and perform other functions. The Corps of Engineers Civil Works Program involves the procurement of a vast amount of concrete for new construction and the evaluation, maintenance, repair, and rehabilitation of a very large number of existing concrete structures. It is essential that, specifications and manuals providing guidance to Corps staff reflect current state-of-the-art technology. Similarly, an awareness of the state-of-the-art is equally necessary to focus the Civil Works R&D Concrete Program toward the highest priority issues.

Hydraulic Engineering Information Analysis Center

The purpose of this center is to acquire, analyze, evaluate, and condense literature into subject areas related to civil engineering hydraulics. The primary audience that center serves is the professional engineering staff of the Corps of Engineers Divisions and Districts. The Center's information and services are available to all Federal agencies, state/local governments, universities, contractors, and the public. The Corps of Engineers Civil Works mission constitutes about 90 percent of the inquiries received by the Center, with about equal division of the remainder among the other groups noted.

In summary, it can be seen from the above that the Corps Civil Works Program is the primary beneficiary of the various centers. The listing of the Department of Defense under service area of previously submitted budget sheets is used in the context of the Corps, and its Civil Works Programs, being part of the Department of Defense.

INLAND WATERWAYS USERS BOARD

Senator JOHNSTON: An appropriation of $280,000 is requested for the first time to support the Inland Waterways Users Board which was created by the Water Resources Development Act, Public Law 99-662. How have the Board's expenses to date been paid and under what authority?

General HEIBERG: The Board's expenses have been paid by the Corps of Engineers. The Board's activities and support are governed by the provisions of the Federal Advisory Committee Act, Public Law 92-463, and the implementing regulations of the Department of Army and the Corps of Engineers, which are AR 15-1 and ER 15-1-1, respectively. The law and regulations require a committee charter which specifies the agency that provides support as the committee ponsor. The Corps of Engineers has been so designated as the sponsor for the Inland Waterways Users Board. Section 12(a) of the Federal Advisory Committee Act specifies that. "Each agency shall be responsible for providing support services for each advisory committee established by or reporting to it unless the establishing authority provides otherwise." The Act creating the Users Board made no other provision for its expenses; therefore, the authority to pay Board expenses is based on the Federal Advisory Committee Act.

Senator JOHNSTON: Where did the funds to cover the Board's expenses to date come from (be specific by program, project, and activity)?

General HEIBERG: A specific account was set up to pay the direct expenses allowed by law for holding Board meetings including travel and related costs of attendance by Board members. This account was funded by reprogramming funds in the Construction, General account.

Senator JOHNSTON: Why is this budget under Remaining Items and not under General Administrative Expenses?

General HEIBERG: The duties of the Board are to provide advice to the Secretary of Army and to Congress on priorities for funding waterway system improvements. Because the Board provides independent oversight of Corps construction expenditures, it was not appropriate to include its expenses in the category that covers general direction and management of the Corps.

Senator JOHNSTON: Could more detailed documentation be supplied regarding the Board's actual expenses, including vouchers and receipts supporting expenses of the board members?

General HEIBERG: Yes. The expenses charged to the special account for Board expenses are all documented. Travel expenses to Board meetings by its members are reimbursed based on the same requirements that apply to government employees. The other expenses charged to the account are for a public meeting room, recordings of meeting proceedings, and Board stationery.

Senator JOHNSTON: How many times is the Board expected to meet this year?

General HEIBERG: The organic legislation requires two meetings a year. The Board met on March 2, 1988 and is scheduled to meet on June 1, 1988. No additional meetings have been set, but the need for a third meeting to produce the Board's 1988 annual report and recommendations was raised as a question at the March 2 meeting.

Senator JOHNSTON: What is the most meetings that could be expected in a year?

General HEIBERG: The law sets no maximum number for meetings in a year. The charter specifies an annual cost for the Board of $80,000, and that number was predicated on three or four meetings per year.

Senator JOHNSTON: What is the basis for the $280,000 funding request for fiscal year 1989?

General HEIBERG: The $280,000 consists of $80,000 for direct expense for Board meetings, as described, and $200,000 for Corps expenses incurred in Board support. The latter is principally for preparation of voluminous briefing materials provided to Board members prior to meetings.

Senator JOHNSTON: Provide for the record a detailed breakout of the budget request by object classification and category for both the Board's and Corps' expenses.

General HEIBERG: The amount requested for Board expense is based on the $80,000 specified in the committee charter. Actual estimated expenses are $5,000 per meeting for reimbursement of member's travel expenses, and $1,500 per meeting for room rental and recordings. The total for three meetings per year would be $19,500. Additional direct expense is estimated at $500 to cover stationery and miscellaneous expenses. At present, the time of Corps employees dedicated to Board support as staff coordinator and recording secretary is in addition to regularly assigned duties. The annual expense for this time is estimated to be $51,000, and would be charged to Board expense. The annual total of the above is $71,000.

The amount requested for Board support is $200,000. Virtually all of this would be for staff time spent in the preparation of briefing materials and analyses for the Board. It includes an estimated $175,000 for personnel, $2,400 for printing and postage and $6,050 per meeting for staff to Board meetings not held in Washington. Based on one Board meeting away from Washington, the annual total of the above is $183,450.

Senator JOHNSTON: What do you expect the annual funding requirements to be over the next five years?

General HEIBERG: $280,000 per year.

DAM SAFETY ASSURANCE PROGRAM

Senator JOHNSTON. Last year the Committee had testimony which indicated that the annual budget request for the Dam Safety Assurance Program would be around $25 - $30 million for the next several years. Why is there no budget request for this program for fiscal 1989. Are projects moving slower than expected; if so, why?

MR. PAGE. The Conference Report which accompanied the Energy and Water Development Appropriation Act, 1988, included $25 million for dam safety assurance new construction starts which may be approved through FY 1998 as a result of studies now underway. Funds in the amount of $4 million and $21 million for FY 1986 and FY 1987, respectively, were included in the Conference Reports which accompanied the appropriation acts for these years. Experience with dam safety assurance studies previously completed and currently underway indicate that the funds allocated for this program to date will be sufficient to initiate any new construction starts that may be approved through FY 1989 as a result of such studies. Therefore, no additional funds are needed. Some dam safety assurance studies are moving slower than expected as the result of the application of newly developed analyses to determine whether upgrading modifications designed to meet current standards and knowledge in the interest of dam safety are effective risk reduction measures. However, a greater impact is due to the fact that many studies show that the dams in question to not warrant modification.

Senator JOHNSTON. Are funds included in the FY 1989 Corps budget for this work: if so, where?

Mr. PAGE. Funds in the amount of $7,429,000 are included in the FY 1989 budget under the Construction, General appropriation to continue five dam safety assurance projects for which studies have been previously approved. The projects are specifically included as part of the budget request for each applicable division. They are:

Appropriation/Project	Amount
Construction, General	
Addicks and Barker Dams, TX	$1,429,000
Mud Mountain Dam, WA	1,200,000
Bolivar Dam, OH	3,200,000
Baldhill Dam, ND	1,000,000
Subtotal	$6,829,000
Flood Control, Mississippi River and Tributaries	
Sardis Dam, MS	600,000
Total	$7,429,000

Senator JOHNSTON. As was the case last year, the Committee is concerned with major changes in program funding from year to year. What do you expect the fund profile to be for the program over the next five years?

Mr. PAGE. Since dam safety needs can arise from a number of factors, it is difficult to predict a funding profile for a five year period. However, based on our funding requests for specifically budgeted projects from FY 1986 through FY 1989, our

COST SHARING FOR DISPOSAL OF MATERIALS ON BEACHES

Senator JOHNSTON. What is the basis of the $1,000,000 funding level for Cost Sharing for Disposal of Material on Beaches?

Mr. Page. Since this is a new program that has not previously been budgeted, we have no experience with actual costs for prior years. We anticipate that non-Federal sponsors will desire to take advantage of opportunities which become apparent during subsurface investigations for plans and specifications for dredging projects and that sufficient time will not be available before contract award to budget for the Federal share of the incremental cost of placing the dredged sand on beaches. Costs will vary from project to project, depending, in part, on the distance between the area being dredged and the beach on which the sand will be placed. We consider the $1,000,000 requested for this effort in the FY 1989 budget to be a nominal amount for this program until some actual costs become available.

Senator JOHNSTON. Would a lesser amount be sufficient to get this program under way until some experience is developed as to funding requirements?

Mr. PAGE. We estimate that the $1,000,000 requested in the budget is a reasonable amount if one or more non-Federal sponsors desire to utilize this program to place dredged sand on beaches depending on the distance between the area being dredged and the beach on which the sand will be placed. Incremental costs of $5 per cubic yard to place sand on a beach as opposed to depositing it in an ocean disposal site are not unlikely. Therefore, the $1,000,000 requested in the FY 1989 budget would allow placement of 400,000 cubic yards of sand under these circumstances based on 50/50 percent Federal/non-Federal cost sharing of the incremental costs.

Senator JOHNSTON. What projects have been identified for funding under this program, what is the cost of each, etc.?

MR. PAGE. At this time, the Virginia Beach project in Virginia is being considered for funding under the Section 933 program to place approximately 964,000 cubic yards of sand dredged from the Cape Henry navigation channel under the Baltimore Harbor and Channels project in Maryland and Virginia. The incremental cost to place the sand on Virginia beach over the cost to deposit it in the Dam Neck offshore disposal area is about $5,221,000 or $5.42 per cubic yard. This compares favorably with the cost of $5.59 per cubic yard to renourish the Virginia Beach project in 1986 in accordance with the specifically budgeted construction project under which this work was undertaken.

DREDGING RESEARCH PROGRAM

Senator JOHNSTON. The appropriation for the Dredging Research Program was $3,000,000 to initiate this program in fiscal 1988. Now, the 1989 budget includes $7,000,000 an increase of 133%, to continue this activity. Explain the basis for such a large increase over the 1988 funding level.

Mr. PAGE. The increase represents a usual buildup from a relatively low initial or ramp-up year to a normal program activity level by the second year. Generally, in a program as large as the Dredging Research Program, considerable time is consumed the first year in preparatory activities such as conducting comprehensive literature research; planning, designing, and constructing testing apparatus; acquiring and installing instrumentation; selecting field sites and planning field measurements and tests; and preparing scopes of work and contractural documents for the procurement of university and private sector services and/or equipment. Though the preparatory activities are usually less cost-intensive than the conduct of the related work, they are crucial to an efficient performance of the research that follows. We have found this basic approach to be highly successful in the past. This basic pattern of a steep ramping-up from first to second year funding, reaching a peak in about the third year, and progressively declining in funding thereafter has been found to be the most efficient general way to conduct our large research programs.

Senator JOHNSTON. How do you expect these program costs to change over the next 5 years? Provide a funding profile for the record.

Mr. PAGE. As you know we are requesting $7.4 million in FY 89. Beyond that point, we anticipate reaching our maximum or peak budget request in FY 90 in the amount of $8.3 million. After that the planned budget requests progressively diminish. A funding profile for the Dredging Research Program is provided as follows:

DREDGING RESEARCH PROGRAM FUNDING PROFILE
($1000)

FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	TOTAL
3000	7400	8300	7500	5500	3300	35,000

Senator JOHNSTON. Will any new work be initiated in FY 89?

Mr. PAGE. The Dredging Research Program focuses on a broad horizon of 5 basic Problem Areas related to the physical aspects of the Corps dredging mission. The respective Problem Areas of the Dredging Research Program are comprised of generically similar and, in some cases, interdependent major research undertakings referred to as work units. There are in total 23 work units in the present formulation, each of which is subdivided into many activities. We have launched the program this year by beginning work in each of the 23 work units. In so doing, we will be able to start providing useful, cost-saving products to the Corps' field operating offices as early as end of the first year of the program. We believe that starting the entire program this year is the best strategy to quickly realize economies of scale in the recurrent cost-intensive business of dredging. In that regard, the Corps expends about $400 million each year in maintenance dredging of the Nation's waterways and harbors. Added to that cost, we expect to perform approximately $200 million a year of new work dredging, over the next 10-year period, to deepen navigation projects authorized by the Water Resources Development Act of 1986.

Senator JOHNSTON. Provide for the record a detailed comparison of how the funds for 1988 and 1989 will be used.

Mr. PAGE. A detailed comparison is provided in the following comparative matrix format.

DREDGING RESEARCH PROGRAM

COMPARISON OF FY 1988 AND FY 1989 FUNDS UTILIZATIONS

WORK UNIT TITLE	FY 88 COSTS ($1000)	FY 88 ACTIVITIES	FY 89 COSTS ($1000)	FY 89 ACTIVITIES
PROBLEM AREA 1 - MATERIAL DISPOSED IN OPEN WATERS				
Boundary Layer Properties	175	Develop theory and caluclations.	220	Finalized computer program.
Entrainment and Transport	240	Develop instrumentation system.	450	Field measurement operation.
Short-Term Fate of Material in Open Waters	108	Prepare computer program.	212	Complete testing facility.
Long-Term Fate of Material in Open Waters	140	Begin development of methodologies.	260	Conduct laboratory experiments.
Field Techniques and Data Analysis	282	Procurement of equipment components.	550	Conduct field data collection.
PROBLEM AREA 2 - MATERIAL PROPERTIES RELATED TO NAVIGATION AND DREDGING				
Depth and Density Measurements in Fluid Mud	160	Initiate development of instrumentation.	350	Continue development of system.
Navigable Depth	100	Inventory of fluid mud locations.	400	Report on potential savings.
Properties of Sediments	75	Start instrument system.	180	Further develop system.
Descriptors for Bottom Sediments	95	Report on specialized equipment.	180	Collect and test sediments.

Descriptors for Rock Material.	60	Design of rotary-linear cutter and reaction frame.	580	Construct cutter and reaction frame.

PROBLEM AREA 3 - DREDGE PLANT EQUIPMENT AND SYSTEM PROCESSES

Improved Draghead Designs.	80	Prepare large-scale model.	300	Complete tests on mechanical knife systems.
Improved Eductors for Sand Bypassing	35	Identify field office requirements.	250	New design of eductor system.
Increased Dredge Pay-Load	175	Analysis of dredge plant parameters.	350	Initiate field testing of improvements.
Dredging Manuals	50	Identify types of manuals needed.	50	Manual outlines.
Single-Point Mooring for Hopper Dredge	80	Establish requirements.	350	Concept design and costs.

PROBLEM AREA 4 - VESSEL POSITIONING, SURVEY CONTROLS, AND DREDGE MONITORING SYSTEMS

Vertical Control and Sea State System	120	Real Time Tide Measurement System Manual.	250	Requirements for sea state system.
Positioning Based on GPS Satellites	130	Establish system requirements.	360	Procure initial hardware.
Production Meter Technology	95	Laboratory testing of production meters.	200	Field test and verify production meters.
Monitoring Hopper Loads	85	Survey of present technology.	285	Begin on improved instrumentation.
Silent Inspector	210	Expand data logger.	325	System concept design.

PROBLEM AREA 5 - MANAGEMENT OF DREDGING OPERATIONS

Dredging Project Operations Research	100	Identify inter-relationships.	250	Begin computer model.
Disposal Site Planning, Design, and Operation	80	Compile and evaluate numerous data sets.	420	Inventory existing sites.
Dredging Cost Estimating Techniques	50	Analysis of present technical procedures.	130	Evaluate new techniques.
Technology Transfer	50	Transferred results by various medias.	170	Transferred results by various medias.
Program Manager's Office	225	Integrated overall program efforts.	330	Integrate overall program efforts.
TOTAL PROGRAM	3000		7402	

Senator JOHNSTON. Also provide for the record an impact statement for each $1,000,000 reduction below the budget request down to the current $3,000,000 level.

Mr. PAGE. This information is provided in matrix format as follows which shows the work to be eliminated and its impact.

DREDGING RESEARCH PROGRAM

IMPACT STATEMENT FOR REDUCING FY 89 BUDGET REQUEST OF $7.4 MILLION TO $3.0 MILLION IN INCREMENTS OF $1.0 MILLION

ELIMINATED WORK UNITS	COST REDUCTION ($1000)	PROGRAMMATIC AND OPERATIONAL IMPACT STATEMENTS
	FIRST CUT - $1,050,000 REDUCTION	
Boundary Layer Properties	220	Reduces capabilities of performing dependent work units. Delays implementing means to optimize use of costly open water disposal sites.
Descriptors for Rock Material	580	Stops any research on rock dredging. Hampers improvements in designing and cost estimating rock-dredging projects and capabilities to prepare better contract specifications.
Dredging Project Operations Research	250	Eliminates research to improve overall management procedures. Operating office must seek individual means of improving management systems.
	SECOND CUT - $2,005,000 REDUCTION	
Eliminate All Work Units Listed Above	1050	Impacts as shown above.
Silent Inspector	325	Stops progress to develop an automated inspection system. Field offices will continue having problems providing adequate numbers of personnel to properly inspect contractors.
Entrainment and Transport	450	Magnifies impacts of eliminating Boundary Layer Properties shown above.
Properties of Sediments	180	Halts progress on a partially completed instrument system. Delays improvements in designing soil dredging projects and preparing better contract specifications.
	THIRD CUT - $3,062,000 REDUCTION	
Eliminate All Work Units Listed Above	2005	Impacts as shown above.
Improved Eductors for Sand Bypassing	250	Development stops on new eductor system design. Reduces possibility of using an improved eductor system on 3 to 4 sand bypassing projects.

Dredging Cost Estimating Techniques	130	Stops effort in making the cost estimating procedure more consistent, technically defensible, and rigorous.
Short-Term Fate of Material in Open Waters	212	Stops improvement in this area and adversely impacts a work unit on planning, design, and operation of open water sites. Reduces field office capabilites to optimize use of disposal sites.
Descriptors for Bottom Sediments	180	Halts any research in dredgeability of soil masses. Hampers improvements in designing and cost estimating soil-dredging projects, and preparation of better contract specs.
Monitoring Hopper Loads	285	Stops research in this area. Field office inspectors must contend with less than desirable technology.

FOURTH CUT - $4,402,000 REDUCTION

Eliminate All Work Units Listed Above	3062	Impacts as shown above.
Long-Term Fate of Material in Open Waters	260	Stops improvement in this area and adversely impacts a work unit on planning, design, and operation of open water sites. Reduces field office capabilities to optimize use of disposal sites.
Field Techniques and Data Analysis	550	Stops improvement in this area and adversely impacts a work unit on planning, design, and operation of open water sites. Reduces field office capabilities to optimize use of disposal sites.
Production Meter Technology	180	Stops research in this area. Field office inspectors must contend with less than desirable technology.
Single-Point Mooring for Hopper Dredge	350	Stops design for this new equipment. Delays cost reductions in projects where material dredged by hopper dredges is used for beach nourishment.

In summary reductions to the budget request of $7.0 million for the Dredging Research Program will eliminate or delay development and implementation of products of research that would provide efficiencies and cost savings far greater than the cost of research.

GENERAL EXPENSES

Senator JOHNSTON. The Congress reduced the funding request for General Expenses in FY 1988 resulting in a reduced allocation for the Office, Chief of Engineers from $46,700,000 requested to $43,950,000. What impact has this reduction has on your ability to oversee and manage the Civil Works program of the Corps?

General HEIBERG. The General Expenses appropriation took what I consider an unfortunate cut of $13,000,000 from the budget request in FY 1988, which we are asking be partially restored in FY 1989. After passage of the Water Resources Development Act of 1986, the major task facing the Corps fell to the headquarters and the divisions. That was to develop the definitive policy guidance to enable our field elements to do it right the first time in negotiating with local sponsors for new projects and developing rules for implementation of the 640 provisions of the Act. The cut in the Office, Chief of Engineers is being applied to non-labor accounts to the maximum extent possible in order to reduce the adverse impact on executive direction and management of the Civil Works program. The result is a delay in the upgrade and procurement of ADP and office automation equipment.

Senator JOHNSTON. What is the justification for the proposed increases in the Office, Chief of Engineers for automation and time sharing support, and supplies and equipment replacement costs?

General HEIBERG. As I previously mentioned, because of the $13,000,000 reduction in our budget in FY 1988, many non-labor expenses were deferred to FY 1989, including such items as ADP equipment and software, supplies, and the replacement of office equipment. The proposed increases in FY 1989 will cover the costs of these deferrals.

Senator JOHNSTON. Similarly, the request for 1988 for the Division Offices was reduced from $65,000,000 to $58,760,000. Has there been an adverse impact because of the reduced allocation for 1988?

General HEIBERG. The adverse impact in the Division Offices is similar to that in the Office, Chief of Engineers. In order to preclude a reduction-in-force of our executive direction and management staff, non-labor expenses were deferred in the Division Offices to the maximum extent possible.

Senator JOHNSTON. Specifically, what makes up the increases requested for supplies, equipment and printing; other services; and automation and time sharing?

General HEIBERG. The increases in the Division Offices are similar to those requested in the Office, Chief of Engineers. They are requested because most of these items could not be funded in FY 1988 due to the large cuts that I have discussed. Specifically, the requests are for office items such as personal computers, local area networking, and copier equipment, as well as supplies to operate these items. Printing costs are primarily for the reproduction of new guidance necessitated by the Water Resources Development Act. Other services include personnel, finance and accounting support provided by centralized activities, and also maintenance contracts for office equipment. The automation and time sharing is primarily for business applications in the Corps of Engineers Management Information System (COEMIS).

DUSTPAN DREDGE

Senator JOHNSTON. The justification material for 1988 for the Dustpan Dredge Replacement program indicated that $12,200,000 had been allocated through 1987. Bring the committee up to date on the status of the program, including schedules for construction of attendant plant and dredges.

General HEIBERG. The dustpan dredge replacement is currently under detailed design, with completion of this phase estimated for August 1988. We plan to award the construction contract in April of 1989, and estimate that construction will be completed in November 1991. Through FY 1988 we estimate that we will have spent almost $5,000,000 on the dredge itself. Attendant plant, including barges, a crewboat, a tender, and a drydock is being acquired over a shorter time frame, with delivery of all attendant plant scheduled for calendar year 1989. Through FY 1988 spending on attendant plant is estimated to be $2,000,000.

Senator JOHNSTON. Provide for the record a funding profile of appropriation needs through completion.

General HEIBERG. Through FY 1988, $12,000,000 in new budget authority has been provided for the dredge and attendant plant. Therefore $28,000,000 of the total cost of $40,000,000 remains to be provided. Of the total $35,174,000 in new authority requested for FY 1989, $12,270,000 is intended for the dustpan dredge. This would leave $15,730,000 in new budget authority to be provided in FY 90 through completion in FY 1992. Our current schedule indicates that the remaining needs for 1990, 1991, and 1992 are $10,000,000, $3,000,000, and $2,730,000, respectively.

Senator JOHNSTON. Has there been a delay or stretch out of this program, if so, why?

General HEIBERG. When we first programmed the dredge replacement in FY 1985, we estimated that we would initiate construction in FY 1986. The schedule has slipped by approximately 2-3 years. The main factor in this slippage was an 18 month delay to allow time for qualified Architect/Engineer firms to be in a position to bid. As you may be aware, there are relatively few firms in the country today with the expertise required to tackle a job of this size. At the time we were preparing our request for proposals, several of those firms were not in a position to bid because of their already heavy workload. To assure a more competitive bid environment, we delayed our request for proposals.

WILMINGTON DISTRICT SIDECASTER DREDGE REPLACEMENT

Senator JOHNSTON. What is the cause of the delay in beginning construction of the Wilmington District sidecaster dredge replacement?

General HEIBERG. The sidecaster dredge replacement has been delayed due to design changes. As originally conceived the dredge would have had the capability to dredge in more than one mode. This additional capability, it was felt, would make the vessel more efficient by increasing its potential utilization. However as the design progressed the Corps realized that a multi-mode dredge would not be as effective in any mode as one designed for a single mode of operation and directed that the design be changed to permit only sidecaster operation. The dredging requirements in the area to be served by this dredge are primarily those requiring sidecaster capabilities.

OTHER FLOATING PLANT

Senator JOHNSTON. It appears that many of the vessels identified for replacement in 1987 and 1988 under other floating plant replacement have been delayed or slipped by a minimum of one year. Could you provide a brief explanation of any delays related to specific vessels?

General HEIBERG. There are a variety of events which can affect the acquisition schedule of an item of floating plant including bid protests and design changes. The Corps requested approval to acquire three replacement survey boats in its FY 1986 program. It was estimated at that time that acquisition of the first one would be completed the following year. All three have slipped a year because the firm with whom the Corps had contracted to buy the first vessel declared bankruptcy. The Corps has now received delivery of the first and is testing it before proceeding with acquisition of the remaining two. The crane barge replacement for the Mobile District and the derrick boat replacement for the Huntington District have both been delayed as the result of design changes. Finally, acquisition of a towboat replacement for the Rock Island District which was also first programmed in FY 1986 has been delayed while the Corps explored the possibility of acquiring a used vessel at a considerable savings. The three available used vessels were tested and none was found to meet minimum specifications. Because of these slippages we have deferred all FY 1989 requested floating plant new starts.

COMMUNICATIONS REPLACEMENT PROGRAM

Senator JOHNSTON. Why has the expected program cost for the out years increased from $23,000,000 to $33,000,000?

General HEIBERG. Unanticipated requirements to replace existing telephone systems currently being leased by Corps activities located in GSA operated facilities have substantially increased the program cost for communications in the out-years. The GSA mandate requiring tenants to purchase telephone systems will also impact on future occupants of GSA facilities. In addition, advances in the areas of microwave transmission, fiber optics, multi - channel transceivers, and other areas of communications technology have provided opportunities to acquire equipment with capabilities and proven reliability that was not available a few yeas ago.

REVOLVING FUND

Senator JOHNSTON. The budget request includes an appropriation of $35,174,000 to the Revolving Fund in fiscal 1989. Provide a detailed breakdown of the request for the record.

General HEIBERG. The requested appropriation of $35,174,000 is for the Corps of Engineers Automation Plan ($22,904,000) and the replacement dustpan dredge ($12,270,000). Both are continuing items for which appropriations have been received in prior years.

MAJOR CHANGES TO CONSTRUCTION PROJECTS

Senator JOHNSTON. As with any large construction program, conditions change and unforeseen things happen which alter the Corps needs and schedules on individual projects. Could you provide for the record a list of those projects where major changed conditions make it impossible for the full use of the funds provided for that project in FY 1988, along with a brief explanation of the problem and schedule for proceeding.

Mr. PAGE. Yes, I will provide the requested table for the record based on revocations to date in FY 1988 equal to or greater than $1 million. However, it should be noted that it is still early in the fiscal year and the revocations reflect our expected delays on these projects as of the present time. Circumstances such as increased contractor earnings due to accelerated rate of operations, settled claims, or real estate deficiency judgements may increase the funding requirements for many of these projects. In a few cases, pending decisions may support restoration of previous revocations. Furthermore, any available funds surplus to the needs of listed projects will be needed to meet funding requirements of other projects. The large number of projects added by the Congress to the FY 1988 program and the unusually high rate of savings and slippage (13 %) exacerbate this need. We expect the delays on many affected projects, particularly those with LCA's under negotiation, to be overcome well before the end of FY 1988, so that there would be no reduction from the requirements reflected for each project in FY 1989.

PROJECTS WITH MAJOR REVOCATIONS OF FY 88 FUNDS

89S-102 26 MAR 88

DIV	PROJECT	FY 88 BUDGET	FY 88 CONF	FY 88 RVCTN	FY 88 REVOC / CONF	REASON FOR REVOCATION
LMVD	LOCK AND DAM 26, MISSISSIPPI RIVER, ALTON, IL & MO	75,000	75,000	(17,331)	-23%	OFFSET REPROGRAMMING IN FY 87
NAD	BALTIMORE HARBOR AND CHANNELS, MD & VA (50-FT DEEPENING)	47,000	34,900	(4,150)	-12%	ALLOW DIKED DISPOSAL AREA CONSOLIDATION
NAD	RICHMOND, VA	10,000	5,000	(1,848)	-37%	DELAY IN ACQUIRING RIGHTS OF WAY BY LOCAL SPONSOR
NCD	NORTH BRANCH CHICAGO RIVER, IL	2,000	4,650	(2,244)	-48%	PENDING DETERMINATION OF AMOUNT TO BE REIMBURSED
NED	PORTSMOUTH HARBOR AND PISCATAQUA RIVER, NH & ME	7,500	7,000	(3,287)	-47%	DELAY IN NEGOTIATING LCA
NED	REVERE BEACH, MA	2,450	1,850	(1,359)	-73%	DELAY IN NEGOTIATING LCA
NED	TOWN BROOK, QUINCY AND BRAINTREE, MA	6,800	5,500	(3,933)	-72%	DELAY IN NEGOTIATING LCA
NPD	LITTLE GOOSE LOCK AND DAM, LAKE BRYAN, WA	0	3,263	(2,838)	-87%	PENDING RESOLUTION OF MITIGATION ISSUES
NPD	LOWER GRANITE LOCK & DAM, WA	0	3,498	(3,042)	-87%	PENDING RESOLUTION OF MITIGATION ISSUES
NPD	MT ST HELENS SEDIMENT CONTROL, WA	50,000	50,000	(4,481)	-9%	REDUCED REQUIREMENTS
NPD	SNETTISHAM, AK	11,000	11,000	(6,566)	-60%	OFFSET REPROGRAMMING IN FY 87
ORD	MONTGOMERY LOCKS AND DAM, OHIO RIVER, PA (REHAB)	7,700	7,700	(3,596)	-47%	OFFSET REPROGRAMMING IN FY 87
SAD	CENTRAL AND SOUTHERN FLORIDA, FL	17,000	17,000	(3,484)	-20%	DELAY IN NEGOTIATING LCA
SAD	CROSS FLORIDA BARGE CANAL, FL	0	10,000	(8,696)	-87%	NOT IN ACCORDANCE WITH CURRENT POLICY
SAD	DADE COUNTY, FL	3,000	3,000	(2,409)	-80%	REDUCED REQUIREMENTS
SAD	DUVAL COUNTY, FL	5,000	3,100	(2,196)	-71%	OFFSET REPROGRAMMING IN FY 87 AND FAVORABLE BIDS
SAD	KISSIMMEE RIVER, FL	0	2,000	(1,739)	-87%	NOT IN ACCORDANCE WITH CURRENT POLICY
SAD	PORTUGUES AND BUCANA RIVERS, PR	28,000	26,000	(10,980)	-42%	OFFSET REPROGRAMMING IN FY 87
SAD	RICHARD B. RUSSELL DAM AND LAKE, GA & SC	23,000	23,000	(7,301)	-32%	OFFSET REPROGRAMMING IN FY 87
SAD	SOWASHEE CREEK, MS	6,000	6,000	(3,218)	-54%	DELAY IN NEGOTIATING LCA
SAD	VILLAGE CREEK, AL	8,000	3,000	(2,109)	-70%	PLANNING DELAY
SPD	MERCED COUNTY STREAMS, CA	2,400	2,400	(1,787)	-74%	DELAY IN NEGOTIATING LCA
SPD	PHOENIX ARIZONA AND VICINITY, AZ (STAGE 2)	38,000	22,500	(1,566)	-7%	OFFSET REPROGRAMMING IN FY 87
SPD	SACRAMENTO RIVER DEEPWATER SHIP CHANNEL, CA	11,000	3,000	(1,109)	-37%	DELAY IN NEGOTIATING LCA
SPD	SAN LUIS REY RIVER, CA	8,500	5,500	(1,983)	-36%	PLANNING DELAY
SPD	SWEETWATER RIVER, CA	4,913	4,913	(3,672)	-75%	DELAYED BY COURT ACTION
SWD	ARCADIA LAKE, OK	4,600	4,600	(2,100)	-46%	DELAY IN NEGOTIATING LCA
SWD	BOGGY CREEK, AUSTIN, TX	8,200	8,200	(4,031)	-49%	PLANNING DELAY
SWD	CLEAR CREEK, TX	4,800	4,800	(2,554)	-53%	DELAY IN ACQUIRING RIGHTS OF WAY BY LOCAL SPONSOR
SWD	COOPER LAKE AND CHANNELS, TX	14,000	19,000	(1,523)	-8%	PLANNING DELAY
SWD	SAN ANTONIO CHANNEL IMPROVEMENT, TX	25,000	25,000	(6,240)	-25%	PLANNING DELAY

NOTE: MAJOR REVOCATIONS ARE 7 PERCENT OR $1 MILLION WHICHEVER IS GREATER

FLOOD CONTROL AND COASTAL EMERGENCIES

Senator JOHNSTON. What is the current status of the Emergency Fund?

LTG HEIBERG. The status of the Emergency Fund as of March 4, 1988, is as follows:

		$ Millions
Balance as of October 1, 1987		$18.5
FY 88 Appropriation		20.0
Revocations (October 1, 1987 - March 4, 1988)		3.0
	SUB-TOTAL	$41.5
Allocations (October 1, 1987 - March 4, 1988)		$17.3
Balance as of March 4, 1988		$24.2

The current balance in the Emergency Fund will meet identified requirements and allows for response to major flood problems. While there are no areas with potential major flood threats identified at this time, the majority of the flood season is still ahead. The extent of any post flood response requirements under the expanded authority provided by Section 917 of PL 99-662 is unknown. If severe flooding develops and the Emergency Fund were to be exhausted, funds can be reprogrammed from other appropriations to meet immediate needs.

Senator JOHNSTON. Why has the inspection of non-Federal levees been transferred into this account from O&M?

LTG HEIBERG. Prior to FY 1984, maintenance compliance inspections for non-Federal flood control projects previously repaired under Public Law 84-99 was accomplished under the Flood Control and Coastal Emergencies funded Disaster Preparedness Program. At that time a decision was made to fund the program under the O&M General appropriation where the companion program for federally constructed projects, Inspection of Completed Works, was funded. Subsequent to the establishment of minimum guidelines in 1986 for engineering and maintenance of non-Federal flood control works, the non-Federal inspection program was greatly expanded to accomplish the required initial eligibility inspections for projects previously repaired under Public Law 84-99. As Public Law 84-99 provides authority to accomplish necessary inspections and the purpose of both the initial eligibility and ongoing maintenance compliance inspections for non-Federal flood control works is to determine eligibility of the projects for future assistance under Public Law 84-99, a decision was made to return funding for these necessary inspections to the Flood Control and Coastal Emergencies Disaster Preparedness Program.

AGRICULTURAL DEVELOPMENT PROJECTS

CHANGE IN EVALUATION

Senator JOHNSTON. Explain the change in evaluating agricultural projects ?

Mr. PAGE. Pursuant to Section 2.3.3 (b) of the Economic and Environmental Principles and Guidelines for Water and

Related Land Resources Implementation Studies, dated March 10, 1983, Federal water resource agencies use normalized commodity prices issued periodically by the Department of Agriculture to evaluate the National Economic Development or NED agricultural benefits of water projects.

In the past, these prices included an upward bias, reflecting the impact of the Government's own price support programs for surplus crops. In the 1970's, this was small. Today, as all of us are aware, the bias has become significant. This results in project benefits from production of surplus crops being overestimated, making uneconomic projects appear economically justified.

Department of Agriculture is now estimating the surplus commodity prices free of subsidy effects. Agriculture first promulgated a list of its new normalized prices on March 31, 1987.

In implementing the new prices, project outputs or benefits, from "program commodities" would be evaluated using the program-free prices. Outputs from "non-program commodities" would be evaluated using the prices based on market conditions with government programs. Program commodities are defined as commodities for which a Department of Agriculture acreage-reduction, price-suport, or deficiency-payment program is in effect for the year when the normalized prices are promulgated.

Normalized prices based on market conditions would be used for all commodities, both program and non-program, to establish the "with" and "without" project conditions, as called for under the Principles and Guidelines, and calculate a farmer's or irrigator's "ability to pay," where required to make this calculation under current law.

PROJECTS IMPACTED

Senator JOHNSON. What projects will be impacted in fiscal 1988 due to postponement of economic evaluation and how much funding originally envisioned for use of these studies will not now be used ?

Mr. PAGE. We are currently in the process of providing implementing guidance on postponing economic evaluation, to field offices and do not have a count on the number of impacted studies. No change in funding requirements is expected since the economic evaluation is merely being postponed to FY 89 and other study activities may be accelerated during the remainder of FY 88.

CORPS FUNDING CAPABILITIES

Senator JOHNSTON. Provide for the record a table showing the Corps funding capability for fiscal 1989 for new and on-going studies, PED, and construction projects.

Mr. PAGE. Due to the compressed budget schedule that resulted after the President signed the Energy and Water Development Appropriation Act in late December 1987, District submissions and Division reviews of capability information were delayed in comparison to prior years. Also, Headquarters' review of Division capabilities submissions are still underway. I will provide the Corps' capabilities for FY 1989 for new and ongoing studies, PED, and construction projects to the Committee as soon as possible.

CAPABILITIES FOR STUDIES UNDERWAY

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
ALABAMA				
FDP	VALLEY CREEK, WARRIOR RIVER AND TRIBUTARIES, AL.	720	190	190
ALASKA				
FDP	ALAKANUK, ALASKA	110	0	110
FDP	KOTLIK, ALASKA	148	0	148
FDP	RIVERS & HARBORS , AK.	8,782	963	963
FDP	SEWARD, ALASKA	100	0	100
FDP	STORM DAMAGE REDUCTION; UNALASKA, AK	187	144	144
ARIZONA				
RCP	ALAMO LAKE, AZ	875	100	100
FDP	GILA RIVER & TRIBUTARIES, AZ	4,955	0	175
FDP	NAVAJO INDIAN RESERVATION, AZ	1,500	400	400
ARKANSAS				
FDP	ARKANSAS RIVER BASIN, AR & OK	2,050	430	430
CALIFORNIA				
SPE	COAST OF CALIFORNIA, STORM AND TIDAL WAVES, CA	7,820	1,000	1,000
N	HUMBOLDT HARBOR AND BAY (DEEPENING), CA	875	350	350
FDP	IMPERIAL AND SAN DIEGO COUNTY STREAMS - SALTON SEA, CA	1,261	100	100
N	LOS ANGELES - LONG BEACH HARBORS, CA	7,820	49	49
FDP	LOS ANGELES COUNTY DRAINAGE AREA REVIEW, CA	5,990	592	592
FDP	MARIN COUNTY SHORELINE, CA-SAN RAFAEL CANAL	700	250	250
N	MORRO BAY HARBOR, CA	854	220	220
FDP	NORTHERN CALIFORNIA STREAMS, AMERICAN RIVER WATERSHED, CA	1,937	600	600
FDP	NORTHERN CALIFORNIA STREAMS, SACRAMENTO METRO AREA, CA	1,125	300	300
FDP	PINE FLAT DAM, KINGS RIVER, CA	1,125	250	250
FDP	SACRAMENTO-SAN JOAQUIN DELTA, CA	2,915	230	230
FDP	SAN FRANCISCO BAY SHORELINE, CA	4,300	222	222
SP	SAN FRANCISCO COUNTY, OCEAN BEACH, CA	850	0	340
FDP	SAN JOAQUIN RIVER BASIN, KAWEAH RIVER, CA	1,125	350	350
FDP	SAN JOAQUIN RIVER BASIN, TULE RIVER, CA.	690	150	150
FDP	SAN LORENZO, CA	1,207	200	200
FDP	SANTA ANA RIVER BASIN AND ORANGE COUNTY, CA	9,540	616	616
SP	SANTA BARBARA COUNTY (BEACH EROSION), CA	940	200	200
RDP	SANTA BARBARA HARBOR, CA	550	130	130
SP	SANTA MONICA BREAKWATER, CA	400	100	100
FDP	UPPER GUADALUPE RIVER, CA	1,200	480	480
FDP	WALNUT CREEK BASIN, CA	1,351	150	150
COLORADO				
FDP	BIG DRY CREEK, ARAPAHOE COUNTY, CO	150	0	150
FDP	BOX ELDER CREEK BASIN, CO	100	0	100
FDP	BOXELDER, SPRING & DRY CREEKS, FT COLLINS, CO	200	0	200
FDP	COLORADO SPRINGS, FOUNTAIN CREEK, CO	510	50	50
FDP	GOOSE CREEK, BOULDER, CO	150	0	150
FDP	PAWNEE & SAND CREEKS, SO PLATTE RIVER, STERLING, CO	150	0	150
FDP	RALSTON AND LEYDEN CREEKS, CO	230	100	100
CONNECTICUT				
COM	WEST CENTRAL CONNECTICUT COASTAL FLOODING, CT	665	100	100
DIST OF COLUMBIA				
SPE	STUDY OF RISING OCEANS	2,000	0	500
FLORIDA				
FDP	BROWARD COUNTY, FL	475	100	100
N	CANAVERAL HARBOR, FL	184	59	59
FDP	COAST OF FLORIDA EROSION AND STORM EFFECTS STUDY, FL	8,230	750	750
N	PORT EVERGLADES HARBOR, FL	165	50	50
FDP	ST PETERSBURG AND VICINITY, FL	625	100	100
FDP	SUWANNEE RIVER, FL	1,737	257	257

CAPABILITIES FOR STUDIES UNDERWAY

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
GEORGIA				
N	SAVANNAH HARBOR COMPREHENSIVE, GA	2,466	0	100
FDP	SAVANNAH RIVER BASIN, GA, SC & NC	660	210	210
IDAHO				
FDP	COLUMBIA RIVER & TRIBS, ID, MT, OR&WA	21,398	904	904
RDP	MUD LAKE, ID	476	125	125
FDP	PALOUSE RIVER AND TRIBUTARIES, ID & WA	517	125	125
FDP	UPPER SNAKE RIVER & TRIBUTARIES, ID & WY	8,210	558	558
ILLINOIS				
FDP	ALEXANDER AND PULASKI COUNTIES, IL	881	300	300
FDP	DES PLAINES RIVER, IL	1,025	200	200
FDP	SALT CREEK, IL	300	0	300
FDP	WEST FRANKFORT AND VICINITY, IL	600	125	125
INDIANA				
FDP	ST. JOSEPH RIVER BASIN, IN & MI	1,000	200	200
IOWA				
FDP	CENTRAL RIVER BASINS OF IOWA, IA	399	0	270
RCP	MISSOURI RIVER LEVEE SYSTEM RE-EVALUATION, IA, NE, MO	500	50	50
FDP	NORTHWEST RIVER BASINS OF IOWA, IA	239	0	190
KANSAS				
FDP	ARK RIVER AND TRIBS, GREAT BEND, KS TO TULSA, OK (REMAINING)	7,340	400	400
FDP	ARKANSAS R FROM GREAT BEND KS TO JOHN MARTIN DAM CO	2,730	0	170
FDP	CANEY RIV, KS & OK	779	150	150
FDP	NEOSHO RIVER ABOVE JOHN REDMOND DAM, KS	1,810	250	250
RCP	SOLDIER CREEK DIVERSION UNIT, TOPEKA, KS	275	0	90
FDP	TURKEY CREEK BASIN, KS & MO	690	170	170
KENTUCKY				
N	CUMBERLAND-TENNESSEE RIVERS, KY, GA, AL, MS, NC, TN & VA	1,443	1,050	1,450
FDP	KENTUCKY RIVER & TRIBUTARIES, KY (STATION CAMP CK INTERIM)	810	180	180
FDP	OHIO RIVER MAIN STEM, KY, IL, IN, OH, PA, & WV	17,570	1,660	1,660
LOUISIANA				
FDP	AMITE RIVER AND TRIBUTARIES, LA	2,209	200	200
N	BAYOU LAFOURCHE AND LAFOURCHE - JUMP WATERWAY, LA	290	85	85
N	GULF INTRACOASTAL WATERWAY, LA & TX SECTION	4,350	210	210
FDP	LOUISIANA COASTAL AREA, LA - HURRICANE PROTECTION	1,296	200	200
FDP	LOUISIANA COASTAL AREA, LA-COMPREHENSIVE COASTAL PLAN	1,300	250	250
FDP	LOUISIANA COASTAL AREA, LA-LAND LOSS AND MARSH CREATION	1,663	170	223
FDP	LOUISIANA COASTAL AREA, LA-MISSISSIPPI RIVER DELTA	1,450	200	200
FDP	LOUISIANA COASTAL AREA, LA-SHORE & BARRIER ISLAND EROSION	1,789	225	245
FDP	MERM, VERM & CALC RIVERS & BY TECHE, LA	5,233	400	400
N	MR-GO BANK EROSION, LA	500	81	81
COM	RED RIVER BASIN, AR AND LA, COMPREHENSIVE STUDY	2,695	450	450
FDP	UPPER BAYOU TECHE, LA	392	82	82
FDP	WEST BANK OF THE MISS. R. IN THE VICINITY OF NEW ORLEANS, LA	1,821	450	450
MAINE				
FDP	ANDROSCOGGIN RIVER, ME & NH	750	200	200
FDP	KENNEBEC RIVER, ME	875	250	250
FDP	PENOBSCOT RIVER, ME	875	250	250
FDP	SACO RIVER, ME & NH	750	150	150

CAPABILITIES FOR STUDIES UNDERWAY

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
MARYLAND				
FDP	CHESAPEAKE BAY & TRIBUTARIES REALLOCATION, MD, PA, VA & NY	2,216	225	225
SP	CHESAPEAKE BAY (SHORELINE EROSION), MD. & VA.	1,985	415	415
SPE	CHESAPEAKE BAY TIME VARIABLE MODEL, MD, VA, PA & DC	1,500	150	150
MASSACHUSETTS				
SP	COASTAL BREACH AT NAUSET BEACH, CHATHAM, MA	750	220	220
COM	SOUTHEASTERN NEW ENGLAND AUTH. REPORTS, MA, RI & CT	3,775	355	355
MICHIGAN				
FDP	SAGINAW RIVER, MI.	3,800	464	464
MINNESOTA				
FDP	MINNESOTA RIVER VALLEY, MN	6,780	139	139
FDP	RAINY RIVER BASIN, MN	1,000	100	100
MISSISSIPPI				
FDP	CANEY CREEK, JACKSON, MS	100	0	100
N	ESCATAWPA RIVER, JACKSON COUNTY, MS	398	173	173
FDP	JACKSON-EAST JACKSON, MS	100	0	100
FDP	LOWER PEARL RIVER BASIN, FLOW DISTRIBUTION, MS & LA	620	200	200
FDP	MISSISSIPPI GULF COASTAL AREAS MS	353	45	45
FDP	PEARL RIVER BASIN, MS & LA.	8,760	122	122
FDP	TOMBIGBEE RIVER AND TRIBUTARIES, MS & AL.	3,533	500	500
MISSOURI				
FDP	BLUE RIVER BASIN, KANSAS CITY, MO	445	145	145
FDP	GRAND RIVER BASIN, MO & IA	775	80	80
FDP	ST. JOSEPH, MO AND VICINITY	535	160	160
NEBRASKA				
FDP	WOOD RIVER, GRAND ISLAND, NE	335	160	160
NEVADA				
FDP	LAS VEGAS WASH AND TRIBUTARIES, NV	1,685	160	160
NEW HAMPSHIRE				
FDP	ASHUELOT RIVER, NH	565	100	100
FDP	MASCOMA RIVER, NH	540	100	100
NEW JERSEY				
N	ARTHUR KILL EXTENSION, HOWLAND HOOK TO CARTERET, NJ & NY	1,425	175	300
FDP	BEATTIES DAM, NJ	750	300	300
N	DELAWARE RIVER COMPREHENSIVE NAVIGATION STUDY, NJ, PA & DE	6,334	316	316
FDP	HACKENSACK RIVER BASIN, NJ & NY	3,284	400	400
N	NEW JERSEY IWW, SHREWSBURY RIVER TO DELAWARE BAY, NJ	370	125	125
SP	PASSAIC RIVER EAST BANK STABILIZATION, NJ	600	200	200
FDP	POPLAR BROOK, NJ	300	50	50
FDP	RARITAN RIVER BASIN , NJ	3,414	0	350
NEW MEXICO				
FDP	CARLSBAD, PECOS RIVER, NM	440	150	150
FDP	RIO GRANDE AND TRIBUTARIES, NM & CO	7,300	200	350
FDP	RIO GRANDE BASIN-REEVALUATION OF OPERATION PLANS, CO, NM & TX	500	250	250
FDP	ROSWELL, PECOS RIVER, NM	850	250	250
NEW YORK				
FDP	BUFFALO METRO AREA, NY	2,830	277	277
SP	LONG BEACH ISLAND, NY	900	200	200
FDP	MOOSE AND BLACK RIVERS, NY	950	190	190
N	ST. LAWRENCE SEAWAY ADDITIONAL LOCKS	4,087	0	25

CAPABILITIES FOR STUDIES UNDERWAY

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
NORTH CAROLINA				
FDP	EASTERN NORTH CAROLINA ABOVE CAPE LOOKOUT, NC	1,602	250	250
N	MOREHEAD CITY HARBOR, NC	490	120	120
FDP	NEUSE RIVER, NC	3,270	448	448
OHIO				
FDP	CENTRAL OHIO SURVEY (GRANDVIEW HEIGHTS INTERIM), OH	421	100	100
FDP	METROPOLITAN REGION OF CINCINNATI, OH, KY, IN	1,100	50	50
FDP	SANDUSKY RIVER, OH	1,030	267	267
OKLAHOMA				
FDP	MIAMI, OK & VICINITY	1,020	50	50
FDP	NORTH CANADIAN RIVER ABOVE LAKE OVERHOLSER, OK	450	125	125
OREGON				
N	COOS BAY, OR (DEEP DRAFT NAVIGATION)	488	80	80
RDP	JOHNSON CREEK OR	0	0	160
COM	WILLAMETTE RIVER BASIN, OR	4,395	328	328
PENNSYLVANIA				
FDP	LACKAWANNA RIVER, PA	1,260	425	425
FDP	MONONGAHELA-YOUGHIOGHENY RIVER BASIN, MD, PA & WV	8,967	600	600
PUERTO RICO				
FDP	ARECIBO RIVER, PR	432	160	160
FDP	GUANAJIBO RIVER, PR	939	210	210
FDP	GUAYANILLA RIVER BASIN, PR	430	100	100
SOUTH DAKOTA				
FDP	BIG SIOUX RIVER, SIOUX FALLS, SD	230	0	100
FDP	WATERTOWN AND VICINITY, SD	520	125	125
TENNESSEE				
FDP	METROPOLITAN REGION OF NASHVILLE, TN	5,353	273	273
TEXAS				
FDP	BRAZOS RIVER AND TRIBUTARIES, TX & NM	8,130	400	400
N	BRAZOS RIVER DIVERSION CHANNEL, TX	700	100	100
FDP	CAMERON COUNTY, TX	1,530	375	375
RCP	DALLAS FLOODWAY, TX	340	75	75
FDP	DENISON DAM-LAKE TEXOMA, OK AND TX	1,930	250	250
FDP	FT. BEND & BRAZORIA COUNTIES, TX	880	100	100
FDP	HILLEBRANDT BAYOU AND TRIBUTARIES, TX	818	200	200
FDP	LITTLE FOSSIL CREEK, VICINITY OF HALTOM CITY, TX	405	75	75
UTAH				
FDP	BEAR RIVER AND TRIBUTARIES, UT, ID & WY	1,000	200	200
VIRGINIA				
FDP	ROANOKE RIVER, UPPER BASIN, VA	200	200	200
WASHINGTON				
N	OLYMPIA HARBOR, WA	369	109	109
N	SNOHOMISH RIVER & TRIBS, WA	955	125	125
WEST VIRGINIA				
COM	KANAWHA RIVER BASIN COMPREHENSIVE (AUTH. REPORTS), WV, VA & N	5,919	453	453
N	KANAWHA RIVER NAVIGATION STUDY, WV	5,995	750	850
FDP	MOOREFIELD, WV	622	259	259
FDP	PETERSBURG, WV	655	180	180
FDP	POTOMAC RIVER BASIN, WV, VA, MD & PA	380	280	280
WISCONSIN				
FDP	LA CROSSE, WI (PHASE 1)	650	280	280

STUDIES AVAILABLE FOR INITIATION

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
AMERICAN SAMOA				
COM	TERRITORIES DEVELOPMENT STUDY, AS	400	400	400
ARKANSAS				
FDP	ARKANSAS RIVER, RUSSELLVILLE-MORRILTON, AR	170	0	170
FDP	CENTRAL ARKANSAS STUDY, AR	600	600	600
CALIFORNIA				
FDP	SAN JOAQUIN RIVER BASIN, CALAVERAS RIVER, CA	1,125	450	450
FDP	UPPER PUTAH CREEK BASIN, CA	500	0	200
DELAWARE				
N	ST. GEORGES BRIDGE STUDY	250	0	250
FLORIDA				
RDP	PANAMA CITY HARBOR, FL	200	0	200
GEORGIA				
N	SAVANNAH HARBOR EXTENTION, GA	300	0	300
ILLINOIS				
RDP	CHICAGO RIVER, NORTH BRANCH (1946 MOD), IL	100	0	100
RDP	WAUKEGAN HARBOR	64	0	64
INDIANA				
FDP	PIGEON CREEK, IN	400	0	400
COM	WABASH RIVER BASIN COMP STUDY - ORANGE COUNTY INTERIM	500	0	500
IOWA				
FDP	SOUTH CENTRAL RIVER BASINS OF IOWA	185	0	185
FDP	THURMAN TO HAMBURG, IA	100	100	100
KANSAS				
N	PRYOR, OK & VICINITY, NAVIGATION, GRAND(NEOSHO)RIV, KS	250	0	250
FDP	WHITEWATER RIV WATERSHED, KS, ARK RIV&TRIBS, GR BEND TO TULSA	250	0	250
KENTUCKY				
FDP	KENTUCKY RIVER AND TRIBUTARIES, KY (JACKSON INTERIM)	400	0	400
FDP	METROPOLITAN LOUISVILLE, KY	500	600	600
LOUISIANA				
SPE	LOUISIANA SHORELINE EROSION INVENTORY	50	0	50
N	MERMENTAU RIVER, GIWW TO THE GULF	219	0	219
FDP	TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS	564	0	564
FDP	VERMILION RIVER & BAYOU TIGRE	265	265	265
MASSACHUSETTS				
N	MERRIMACK RIVER, HAVERHILL TO MOUTH, MA.	200	0	200
N	MERRIMACK RIVER, LAWRENCE TO HAVERHILL, MA	200	0	200
MICHIGAN				
FDP	SOUTHERN WAYNE COUNTY, MI	455	130	130
N	ST JOSEPH HARBOR DEEP DRAFT, MI	130	0	130
MINNESOTA				
FDP	CROOKSTON, MN	360	0	360
RDP	WAHPETON, ND - BRECKENRIDGE, MN	250	100	100
MISSOURI				
FDP	CHARITON & LITTLE CHARITON RIVERS AND TRIBS, IA & MO	205	0	205
FDP	DARDENNE CREEK, MO (INTERIM - ST. LOUIS METRO)	250	0	250
RDP	DRY FORK AND EAST FORK LAKES, FISHING RIVER, MO	200	0	200
FDP	WYACONDA RIVER BASIN, MO	220	0	220

STUDIES AVAILABLE FOR INITIATION

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
MONTANA				
FDP	MILK RIVER, MT	120	0	120
NEBRASKA				
FDP	ANTELOPE CREEK, LINCOLN, NE	120	120	120
NEVADA				
FDP	ELKO, NV	750	0	300
FDP	LOVELOCK, NV	750	0	300
NEW JERSEY				
FDP	PASSAIC RIVER BASIN ACQUISITION, NJ (SEC. 1148)	300	0	300
NEW MEXICO				
FDP	LAS VEGAS, PECOS RIVER, NM	200	0	200
NEW YORK				
N	HUDSON RIVER CHANNEL, NY	500	0	500
NORTH CAROLINA				
FDP	SIX-MILE CREEK, NC & SC	150	0	150
NORTH DAKOTA				
FDP	GRAND FORKS, ND	310	0	310
OHIO				
FDP	MIAMI RVR, LITTLE MIAMI RVR, & MILL CRK. BSNS, VERSAILLES, OH	300	0	300
SPE	TRUMBULL COUNTY, OH	150	0	150
OKLAHOMA				
FDP	CRUTCHO CREEK, OK	250	0	250
FDP	KEYSTONE DAM TO TULSA, ARKANSAS RIVER OK	250	250	250
PENNSYLVANIA				
FDP	MONONGAHELA RIVER BASIN (FDP), PA	500	0	500
PUERTO RICO				
N	GUAYANES, LAS MAREAS & GUAYANILLA HARBORS, PR	135	0	135
FDP	RIO NIGUA AT SALINAS, PR	100	100	100
COM	TERRITORIES DEVELOPMENT STUDY, VI	250	0	250
SOUTH DAKOTA				
FDP	SOUTH DAKOTA LAKES, SD (WRDA, 1986)	150	0	150
FDP	JAMES RIVER BASIN, SD	350	25	25
FDP	VERMILLION RIVER AND TRIBUTARIES, SD	200	0	200
TEXAS				
FDP	CENTRAL COLORADO RIVER BASIN, TX	270	270	270
N	CHANNEL TO VICTORIA, TX. (DEEP DRAFT)	180	0	180
FDP	EL PASO AND VICINITY, TX & NM	300	300	300
RCP	FORT WORTH FLOODWAY, TX	400	0	400
RCP	GULF INTRACOASTAL WATERWAY, TX. (SEC. 216)	350	0	350
SP	MATAGORDA COUNTY SHORE, TX	160	0	160
N	PORT LAVACA TO RED BLUFF, TX	100	0	100
FDP	SAN BERNARD RIVER WATERSHED, TX	250	0	250
UTAH				
FDP	WEBER RIVER, UT	1,000	0	400
VIRGINIA				
RCP	AIWW BRIDGE AT GREAT BRIDGE, VA	300	0	150
RCP	GREAT BRIDGE LOCK, VA	1,000	0	250
N	JAMES RIVER NAVIGATION, VA	200	200	200
FDP	UPPER JAMES RIVER, VA	250	0	250
FDP	WAYNESBORO, VA	175	175	175

STUDIES AVAILABLE FOR INITIATION

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
WASHINGTON				
RCP	HOWARD HANSON DAM, WA	60	0	60
WEST VIRGINIA				
FDP	LITTLE KANAWHA RIVER BASIN, WV	350	350	350
WISCONSIN				
N	FOX RIVER CHANNEL GREEN BAY, WI	140	0	140

CAPABILITIES FOR CONTINUING PRECONSTRUCTION ENGINEERING & DESIGN

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
ALABAMA				
N	BAYOU LA BATRE, AL	320	200	200
ALASKA				
FC	HOMER SPIT STORM DAMAGE REDUCTION, AK	347	130	130
N	KODIAK HARBOR, AK	918	475	475
ARIZONA				
FC	CLIFTON, AZ	1,100	450	450
FC	HOLBROOK, AZ	1,350	220	220
FC	NOGALES WASH, AZ	850	300	300
FC	OLD CROSS CUT CANAL, AZ	1,050	150	150
FC	RILLITO, AZ	1,340	290	290
CALIFORNIA				
FC	CACHE CREEK BASIN (OUTLET CHANNEL), CA	1,950	250	250
FC	CALIENTE CREEK, CA	3,000	1,200	1,200
FC	COYOTE & BERRYESSA CREEKS, CA	1,600	800	800
FC	DRY CREEK, ROSEVILLE, CA	1,100	400	400
FC	GUADALUPE RIVER, CA	2,000	611	611
N	NOYO RIVER AND HARBOR (BREAKWATER), CA	1,560	200	200
N	OCEANSIDE HARBOR, CA	350	240	240
N	REDONDO BEACH (KING HARBOR), CA	600	250	250
DIST OF COLUMBIA				
FC	WASHINGTON, DC & VICINITY	2,300	470	470
FLORIDA				
N	FORT PIERCE HARBOR, FL	496	200	200
N	HUDSON RIVER, FL	200	200	200
N	MIAMI HARBOR CHANNEL, FL	1,500	700	700
N	MIAMI HARBOR CLEANUP, FL	400	100	100
BE	PANAMA CITY BEACHES, FL	3,500	250	250
BE	SARASOTA COUNTY, FL	375	175	175
BE	ST JOHNS COUNTY, FL	350	70	70
N	TAMPA BAY (PORT SUTTON), FL	250	125	125
HAWAII				
FC	ALENAIO STREAM, HI	750	200	200
N	KAWAIHAE SMALL BOAT HARBOR, HI	328	157	157
N	MAALAEA HARBOR, MAUI, HI	405	210	210
ILLINOIS				
N	LOCKS AND DAMS 52 AND 53, IL & KY (OLMSTED)	20,939	2,500	5,000
FC	LOVES PARK, IL	1,300	209	209
FC	MCCOOK AND THORNTON RESERVOIRS (CUP), IL	5,600	1,425	2,200
FC	O'HARE RESERVOIR, IL	850	365	365
FC	RUSSELL & ALLISON LEVEE 1936 ACT LAWRENCE	1,025	0	150
INDIANA				
FC	FORT WAYNE METROPOLITAN AREA, IN	1,275	400	400
FC	LITTLE CALUMET RIVER, IN	1,815	240	240
IOWA				
FC	MUSCATINE ISLAND LEVEE & DRAINAGE DISTRICT, IA	400	150	150
FC	PERRY CREEK, IA	1,080	187	187
FC	WEST DES MOINES-DES MOINES, IA	1,100	250	250
KANSAS				
FC	DOUGLASS LAKE, KS	3,100	750	750
FC	UPPER LITTLE ARKANSAS RIVER WATERSHED, KS	650	200	200
KENTUCKY				
FC	FRANKFORT (SOUTH FRANKFORT), KY	1,217	175	175
LOUISIANA				
FC	WESTWEGO TO HARVEY CANAL, LA	1,600	600	600
MARYLAND				
BE	ATLANTIC COAST OF MD AND ASSATEAGUE ISLAND, VA	2,600	709	709

CAPABILITIES FOR CONTINUING PRECONSTRUCTION ENGINEERING & DESIGN

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
MASSACHUSETTS				
FC	BROCKTON, MA	875	200	200
FC	MASSACHUSETTS COASTAL, ROUGHANS POINT, REVERE, MA	1,000	295	295
MINNESOTA				
N	DULUTH - SUPERIOR HARBOR, MN & WI	746	150	150
FC	MISSISSIPPI RIVER AT ST. PAUL, MN	1,100	350	350
FC	ROOT RIVER AT HOUSTON, MN	1,000	260	260
MISSISSIPPI				
N	GULFPORT HARBOR, MS	2,000	231	231
N	PASCAGOULA HARBOR, MS	1,135	260	260
FC	PEARL RIVER, SHCCCOE DAM, MS	3,500	600	600
MISSOURI				
FC	BRUSH CREEK, KANSAS CITY, MO	1,700	390	390
FC	CAPE GIRARDEAU - JACKSON METRO AREA, MO.	2,700	600	1,190
FC	MALINE CREEK, MO	4,200	600	600
NEVADA				
FC	TRUCKEE MEADOWS, NV	4,300	1,600	1,600
NEW JERSEY				
N	DELAWARE RIVER, VICINITY OF CAMDEN, BECKETT ST TERMINAL, NJ	250	30	30
BE	GREAT EGG HBR INLET & PECK BE, NJ (GROUP I)	570	0	50
FC	LOWER SADDLE RIVER, NJ	3,900	750	750
N	NEW YORK HBR & ADJ CHANNELS, PORT JERSEY, NJ	1,400	500	500
FC	PASSAIC RIVER MAINSTEM, NJ	27,500	750	1,300
FC	PINE BROOK, MANALAPAN TWP, NJ	150	75	75
FC	RAMAPO RIVER AT OAKLAND, NJ	1,300	470	470
FC	RARITAN RIVER BASIN, GREEN BROOK SUB-BASIN, NJ	5,300	1,500	1,500
NEW MEXICO				
FC	RIO GRANDE FLOODWAY, SAN ACACIA TO BOSQUE DEL APACHE, NM	1,390	450	450
NEW YORK				
BE	ATLANTIC COAST OF NEW YORK CITY (CONEY ISLAND), NY	1,800	600	600
N	GOWANUS CREEK CHANNEL, NY	500	200	200
N	OLCOTT HARBOR, NY	1,100	350	350
FC	WESTCHESTER CO STREAMS, MAMARONECK & SHELDRAKE RIVERS, NY	3,000	90	90
FC	WESTCHESTER CO STREAMS, TOWN OF MAMARONECK, NY	700	250	250
NORTH CAROLINA				
FC	BRUNSWICK COUNTY, NC	300	150	150
N	WILMINGTON HARBOR - NORTHEAST (CAPE FEAR) RIVER, NC	680	175	175
OHIO				
FC	FAIRFIELD, OH	1,209	150	150
FC	LOGAN, OH	1,126	300	300
N	LORAIN HARBOR, OH	460	136	136
FC	NELSONVILLE, OH	1,316	355	355
FC	NORTH CHILLICOTHE, SCIOTO RIVER, OH	1,350	600	600
OKLAHOMA				
FC	FRY CREEKS, BIXBY, OK	1,300	500	500
PENNSYLVANIA				
FC	PROMPTON LAKE, PA (MOD)	3,900	1,000	1,000
FC	SUSQUEHANNA BASIN AT HARRISBURG, PA	4,600	540	540
FC	WYOMING VALLEY LEVEE RAISING, PA	7,700	1,550	1,770
PUERTO RICO				
FC	RIO PUERTO NUEVO, PR	6,000	1,700	1,700

CAPABILITIES FOR CONTINUING PRECONSTRUCTION ENGINEERING & DESIGN

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
TEXAS				
FC	BEALS CREEK, BIG SPRING, TX	676	150	150
N	BRAZOS ISLAND HARBOR, TX (42-FOOT PROJECT)	1,230	400	400
FC	SIMS BAYOU, HOUSTON, TX	2,300	455	455
N	TEXAS CITY CHANNEL, TX (50-FOOT PROJECT)	2,000	413	413
VIRGINIA				
FC	ROANOKE RIVER UPPER BASIN, VA, HEADWATERS AREA	1,515	465	465
BE	VIRGINIA BEACH, VA (HURRICANE PROTECTION)	2,860	660	660
WASHINGTON				
FC	CENTRALIA, WA	1,740	650	650
FC	CHEHALIS RIVER AT SOUTH ABERDEEN AND COSMOPOLIS, WA	1,564	0	317
N	GRAYS HARBOR, CHEHALIS & HOQUIAM RIVER, WA	5,370	1,070	1,070
FC	ZINTEL CANYON DAM, WA	1,082	500	500

CAPABILITIES FOR INITIATION OF PRECONSTRUCTION ENGINEERING & DESIGN

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
ARIZONA				
FC	LOWER MISSION CREEK, CA	800	0	350
ARKANSAS				
N	WHITE RIVER NAVIGATION TO BATESVILLE, AR	2,000	0	400
CALIFORNIA				
FC	NAPA RIVER, CA	4,000	550	550
CONNECTICUT				
FC	WESTCHESTER CO STREAMS, BYRAM RIVER, CT.	1,100	0	300
HAWAII				
N	HILO HARBOR, HI (1986 WRDA)	560	0	200
IDAHO				
FC	LITTLE WOOD RIVER, GOODING/SHOSHONE, ID	500	0	200
KANSAS				
FC	ARKANSAS CITY, KS	500	0	400
KENTUCKY				
FC	HAZARD, KY	1,000	0	300
MASSACHUSETTS				
N	MERRIMACK RIVER, LOWELL TO LAWRENCE, MA	480	0	80
MICHIGAN				
N	GREAT LAKES CONNECTING CHANNELS AND HARBORS REPLACEMENT LOCK	8,600	0	500
MINNESOTA				
N	GREAT LAKES CONNECTING CHANNELS AND HARBORS FINAL REPORT	420	0	100
MISSOURI				
FC	COLDWATER CREEK, MO	2,000	0	500
NEW JERSEY				
FC	MOLLY ANN'S BROOK, NJ	1,900	250	250
N	NEW YORK HBR & ADJ CHANNELS, CLAREMONT TERMINAL, NJ	1,350	0	300
NEW MEXICO				
FC	ABIQUIU DAM (EMERGENCY GATES), NM	200	150	150
NORTH CAROLINA				
FC	SUGAR CREEK BASIN, NC & SC	1,637	0	470
OHIO				
FC	KILLBUCK LPP, MUSKINGUM RIVER, OH	600	0	300
FC	WEST COLUMBUS, OHIO	1,800	0	900
FC	WHEELING CREEK, WATERSHED, INTERIM MEASURES, OHIO	600	0	200
FC	WHEELING CREEK, WATERSHED, OVERALL PLANNING, OHIO	375	0	125
PENNSYLVANIA				
FC	SAW MILL RUN, PITTSBURGH, PA	1,100	300	300
PUERTO RICO				
FC	RIO DE LA PLATA, PR	2,600	0	700
N	SAN JUAN HARBOR, PR	2,000	0	520
TEXAS				
N	CHANNEL TO VICTORIA, TX	650	250	250
FC	FIVE MILE CREEK, DALLAS, TX	750	150	150
FC	LOWER RIO GRANDE BASIN, TX	3,300	0	350
N	SABINE RIVER CHANNEL, TEXAS (MODIFICATION)	160	0	100

CAPABILITIES FOR INITIATION OF PRECONSTRUCTION ENGINEERING & DESIGN

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
UTAH				
FC	UPPER JORDAN RIVER, UT..................	600	0	400
WEST VIRGINIA				
FC	ISLAND CREEK BASIN IN AND AROUND LOGAN,. WEST VIRGINIA............................	1,600	0	700
FC	ROWLESBURG LAKE, WV (1965 ACT)..........	3,600	0	500
WISCONSIN				
FC	WISCONSIN RIVER AT PORTAGE, WI...	825	0	300

CAPABILITIES FOR CONSTRUCTION PROJECTS UNDERWAY

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
ALABAMA				
N	BLACK WARRIOR AND TOMBIGBEE RIVERS, VICINITY OF JACKSON, AL	1,905	50	50
N	MOBILE HARBOR, AL	258,550	9,685	9,685
FC	THREEMILE CREEK, MOBILE, AL	13,970	4,500	4,500
FC	VILLAGE CREEK, JEFFERSON COUNTY, AL	26,335	3,800	3,800
N	WILLIAM BACON OLIVER LOCK AND DAM, AL	121,000	31,000	31,000
ALASKA				
MP	SNETTISHAM, AK	133,000	5,845	5,845
N	ST. PAUL HARBOR, AK	13,648	7,000	7,000
ARIZONA				
FC	PHOENIX ARIZONA AND VICINITY, AZ (STAGE 2)	231,000	41,000	41,000
ARKANSAS				
FC	FOURCHE BAYOU BASIN, LITTLE ROCK, AR	14,000	2,500	2,500
N	MCCLELLAN-KERR ARK. RVR NAV. SYSTEM LOCKS AND DAMS, AR & OK	561,000	8,500	8,500
N	OUACHITA AND BLACK RIVERS, AR & LA	258.000	2,000	2,000
CALIFORNIA				
FC	CORTE MADERA CREEK, CA	14,400	1,800	1.800
FC	DRY CREEK (WARM SPRINGS) LAKE, CA	349,000	750	750
FC	FAIRFIELD VICINITY STREAMS, CA	11,000	2,400	2,400
FC	LOWER SAN JOAQUIN RIVER, CA	22,576	1,500	1,500
FC	MERCED COUNTY STREAMS, CA	65,200	4,000	4,000
N	OAKLAND HARBOR, CA	21,600	10,000	10,000
FC	PAJARO RIVER, CA	5,395	2,470	2,470
FC	REDBANK AND FANCHER CREEK, CA	52,200	4,500	4,500
N	RICHMOND HARBOR, CA	8,000	430	430
FC	SACRAMENTO RIVER BANK PROTECTION PROJECT, CA	95,800	10,000	10,000
N	SACRAMENTO RIVER DEEPWATER SHIP CHANNEL, CA	41,200	5,300	5,300
FC	SACRAMENTO RIVER FLOOD CONTROL PROJECT, CA (DEF CORR)	74,800	2,285	2.285
N	SAN FRANCISCO BAY TO STOCKTON, CA	132,000	1,700	1 700
FC	SAN LUIS REY RIVER, CA	32,600	6,200	6.200
BE	SURFSIDE-SUNSET-NEWPORT BEACH, CA	30,200	1,300	1,300
FC	WALNUT CREEK, CA	63,400	6,300	6,300
FC	WILDCAT AND SAN PABLO CREEKS, CA	21,500	1,800	1,800
COLORADO				
FC	CHATFIELD LAKE, CO	95,000	400	400
FC	FOUNTAIN CREEK, PUEBLO, CO	6,270	2,700	2,700
FC	WESTERLY CREEK, CO	7,607	5,100	5,100
DELAWARE				
FC	DELAWARE COAST PROTECTION, DE	8,750	525	525
FLORIDA				
FC	CENTRAL AND SOUTHERN FLORIDA, FL	838,000	19,000	19,000
FC	DADE COUNTY, FL	48,800	1,900	1,900
BE	DUVAL COUNTY, FL	16,400	3,443	3,443
FC	FOUR RIVER BASINS, FL	153,000	800	800
BE	INDIAN RIVER COUNTY, FL	27,300	0	5,440
N	MANATEE HARBOR, FL	9.430	5,000	5,000
BE	PINELLAS COUNTY, FL	20,000	4,000	4,000
GEORGIA				
FC	GATES CREEK, RICHMOND COUNTY, GA	9,875	2,000	2,000
MP	RICHARD B. RUSSELL DAM AND LAKE, GA & SC	554,000	32,000	32,000
N	SAVANNAH HARBOR, GA	8,800	5,760	5,760
GUAM				
FC	AGANA RIVER, GU	4,090	1,840	1,840
HAWAII				
FC	KAHOMA STREAM, MAUI, HI	10,840	1,784	1,784

CAPABILITIES FOR CONSTRUCTION PROJECTS UNDERWAY

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
ILLINOIS				
FC	ALTON TO GALE ORGANIZED LEVEE DISTRICTS, IL & MO (DEF CORR)	92,345	1,000	1,000
FC	EAST ST. LOUIS, IL	17,250	3,000	3,000
N	LOCK AND DAM 26, MISSISSIPPI RIVER, ALTON, IL & MO	752,000	50,000	50,000
N	LOCK AND DAM 26, SECOND LOCK, MISS. RIVER, ALTON, IL & MO	213,000	13,000	13,000
FC	NORTH BRANCH CHICAGO RIVER, IL	16,600	4,000	4,000
FC	SOUTH QUINCY LEVEE AND DRAINAGE DISTRICT, IL	7,550	3,600	3,600
N	UPPER MISS. RVR SYSTEM ENV MGT PROG, IL, IA, MO, MN, & WI	191,000	7,000	7,000
INDIANA				
FC	EVANSVILLE, IN	49,500	4,000	4,000
IOWA				
FC	DES MOINES RECREATION RIVER AND GREENBELT, IA	4,623	750	750
FC	MISSOURI RIVER LEVEE SYSTEM, IA, NE KS, & MO	138,861	350	350
KANSAS				
FC	GREAT BEND, KS	31,600	3,500	3,500
FC	HALSTEAD, KS	5,800	1,800	1,800
KENTUCKY				
FC	BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA, KY & TN	132,072	4,500	4,500
FC	PAINTSVILLE LAKE, KY	63,784	500	500
FC	SOUTHWESTERN JEFFERSON COUNTY, KY	57,700	3,083	3,083
FC	TAYLORSVILLE LAKE, KY	92,420	540	540
FC	YATESVILLE LAKE, KY	104,000	11,800	11,800
LOUISIANA				
FC	GRAND ISLE AND VICINITY, LA	14,661	1,500	1,500
FC	LAKE PONTCHARTRAIN AND VICINITY, LA (HURRICANE PROTECTION)	521,000	40,400	40,400
FC	LAROSE TO GOLDEN MEADOW, LA (HURRICANE PROTECTION)	69,400	2,970	2,970
N	MISSISSIPPI RIVER - GULF OUTLET, LA	509,000	500	500
N	MISSISSIPPI RIVER SHIP CHANNEL, GULF TO BATON ROUGE, LA	143,000	3,800	3,800
FC	NEW ORLEANS TO VENICE, LA (HURRICANE PROTECTION)	225,000	12,900	12,900
FC	OUACHITA RIVER LEVEES, INCLUDING BAWCOMVILLE, LA	8,300	900	900
FC	PEARL RIVER, SLIDELL, ST. TAMMANY PARISH, LA	19,200	400	400
N	RED RIVER WATERWAY, MISSISSIPPI RIVER TO SHREVEPORT, LA	1,643,000	118,000	118,000
MAINE				
N	JONESPORT HARBOR, ME	8,100	1,800	1,800
BE	ROOSEVELT CAMPOBELLO INTERNATIONAL PARK, LUBEC, ME & CANADA	200	200	200
MARYLAND				
N	BALTIMORE HARBOR AND CHANNELS, MD & VA	148,000	27,600	27,600
MASSACHUSETTS				
BE	REVERE BEACH, MA	7,605	3,510	3,510
FC	TOWN BROOK, QUINCY AND BRAINTREE, MA	21,600	7,950	7,950
MINNESOTA				
FC	BASSETT CREEK, MN	24,900	1,500	1,500
FC	CHASKA, MN	20,500	1,000	1,000
FC	MANKATO AND NORTH MANKATO, MN	95,700	2,219	2,219
FC	REDWOOD RIVER AT MARSHALL, MN	5,260	0	900
FC	SOUTH FORK ZUMBRO RIVER AT ROCHESTER, MN	61,200	7,100	7,100
MISSISSIPPI				
FC	SOWASHEE CREEK, MERIDIAN, MS	13,743	5,400	5,400
FC	TOMBIGBEE RIVER AND TRIBUTARIES, MS & AL	48,000	2,595	2,595

CAPABILITIES FOR CONSTRUCTION PROJECTS UNDERWAY

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
MISSOURI				
FC	BLUE RIVER CHANNEL, KANSAS CITY, MO	174,000	9,116	9,116
FC	HANNIBAL, MO	4,690	1,000	1,000
MP	HARRY S. TRUMAN DAM AND RESERVOIR, MO	550,000	6,445	6,445
FC	LITTLE BLUE RIVER LAKES, MO	140,500	3,017	3,017
FC	MERAMEC RIVER BASIN, MISSOURI	10,420	0	800
N	MISS. RIVER BTWN OHIO AND MO RIVERS (REG. WORKS), MO & IL	187,000	4,400	4,400
NEBRASKA				
FC	MISSOURI NATIONAL RECREATIONAL RIVER, NE & SD	21,000	75	75
FC	PAPILLION CREEK AND TRIBUTARIES LAKES, NE	57,300	3,547	3,547
NEW HAMPSHIRE				
N	PORTSMOUTH HARBOR AND PISCATAQUA RIVER, NH & ME	11,250	6,900	6,900
NEW JERSEY				
N	BARNEGAT INLET, NJ	29,480	7,800	7,800
BE	CAPE MAY INLET TO LOWER TOWNSHIP, NJ	70,700	1,000	1,000
FC	LIBERTY STATE PARK LEVEE AND SEAWALL, NJ	18,200	4,778	4,778
BE	SANDY HOOK TO BARNEGAT INLET, NJ	199,000	1,200	1,200
NEW MEXICO				
FC	ACEQUIAS IRRIGATION SYSTEM, NM	40,000	0	4,000
FC	ALAMOGORDO, NM	22,800	7,400	7,400
FC	PUERCO RIVER AT GALLUP, NM	5,250	3,100	3,100
FC	RIO GRANDE FLOODWAY, TRUTH OR CONSEQUENCES UNIT, NM	11,700	3,800	3,800
NEW YORK				
FC	ARDSLEY, NY	4,830	2,680	2,680
FC	ELLICOTT CREEK, NY	10,254	1,200	1,200
N	HEMPSTEAD HARBOR, NY	2,130	400	400
N	KILL VAN KULL AND NEWARK BAY CHANNEL, NY & NJ	193,000	54,300	54,300
N	MORICHES INLET, NY	9,100	1,225	1,225
N	NEW YORK HARBOR COLLECTION AND REMOVAL OF DRIFT, NY & NJ	51,900	1,409	1,409
NORTH CAROLINA				
N	AIWW-REPLACEMENT OF FEDERAL HIGHWAY BRIDGES, NC	68,700	550	550
FC	B. EVERETT JORDAN DAM AND LAKE, NC	138,000	4,468	4,468
FC	CAROLINA BEACH AND VICINITY, NC	16,700	300	300
FC	FALLS LAKE, NC	165,000	8,000	8,000
NORTH DAKOTA				
FC	SOURIS RIVER BASIN, ND	80,100	17,600	17,600
OHIO				
FC	MILL CREEK, OH	159,000	20,000	20,000
FC	NEWARK, OH	10,100	2,082	2,082
FC	RENO BEACH HOWARD FARMS, OH	5,540	1,610	1,610
OKLAHOMA				
FC	ARCADIA LAKE, OK	89,700	2,000	2,000
FC	MINGO CREEK, OK	110,000	6,200	6,200
FC	PARKER LAKE, OK	47,100	2,000	2,000
OREGON				
N	BONNEVILLE NAVIGATION LOCK, OR & WA	212,000	42,000	42,000
MP	BONNEVILLE SECOND POWERHOUSE, OR & WA	672,000	2,500	2,500
FC	ELK CREEK LAKE, OR	116,300	1,900	1,900
FC	LOWER COLUMBIA RIVER BASIN BANK PROTECTION, OR & WA	24,700	200	200

CAPABILITIES FOR CONSTRUCTION PROJECTS UNDERWAY

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
OREGON				
FC	WILLAMETTE RIVER BASIN BANK PROTECTION, OR.	29,200	160	160
PENNSYLVANIA				
FC	FRANCIS E. WALTER DAM, PA (MODIFICATION).	20,600	4,200	4,200
N	GRAYS LANDING, LOCK AND DAM 7, MONONGAHELA RIVER, PA.	165,000	14,200	14,200
N	POINT MARION, LOCK AND DAM 8, MONONGAHELA RIVER, PA & WV.	82,900	2,600	3,800
BE	PRESQUE ISLE PENINSULA, PA (NOURISHMENT).	16,044	1,230	1,230
BE	PRESQUE ISLE PENNISULA, PA.	13,700	4,000	4,000
FC	TAMAQUA, PA.	9,225	1,640	1,640
FC	TURTLE CREEK, PA.	17,151	200	200
PUERTO RICO				
FC	PORTUGUES AND BUCANA RIVERS, PR	302,000	26,000	26,000
SOUTH CAROLINA				
N	CHARLESTON HARBOR, SC.	75,350	7,000	7,000
TEXAS				
FC	BOGGY CREEK, AUSTIN, TX.	15,800	8,000	8,000
FC	CLEAR CREEK, TX.	50,500	4,300	4,300
FC	COOPER LAKE AND CHANNELS, TX.	133,000	21,800	25,800
N	CORPUS CHRISTI SHIP CHANNEL, TX.	57,700	4,000	4,000
FC	EL PASO, TX.	108,700	4,400	4,400
N	FREEPORT HARBOR, TX.	57,900	11,300	11,300
FC	JOE POOL LAKE, TX.	184,000	4,500	4,500
FC	LAKE WICHITA, HOLLIDAY CREEK AT WICHITA FALLS, TX.	29,600	7,500	7,500
N	MOUTH OF COLORADO RIVER, TX.	32,600	5,600	5,800
FC	RAY ROBERTS LAKE, TX.	294,000	20,000	20,000
FC	SAN ANTONIO CHANNEL IMPROVEMENT, TX.	116,000	25,000	25,000
FC	TAYLORS BAYOU, TX.	41,000	4,400	4,400
UTAH				
FC	LITTLE DELL LAKE, UT.	33,300	7,800	7,800
VIRGINIA				
N	LYNNHAVEN INLET AND CONNECTING CHANNELS, VA.	1,934	1,600	1,600
N	NORFOLK HARBOR AND CHANNELS, VA.	117,000	2,700	2,700
FC	RICHMOND, VA.	67,700	11,100	11,100
BE	TANGIER ISLAND SHORELINE PROTECTION VA.	2,840	2,576	2,576
FC	VIRGINIA BEACH STREAMS CANAL NO. TWO, VA.	4,800	757	757
WASHINGTON				
MP	CHIEF JOSEPH ADDITIONAL UNITS, WA.	413,000	6,600	6,600
MP	LOWER SNAKE RVR FISH & WILDLIFE COMPENSATION, WA, OR, & ID	185,000	12,200	12,200
FC	MT. ST. HELENS SEDIMENT CONTROL, WA.	152,000	21,500	21,500
WEST VIRGINIA				
N	GALLIPOLIS LOCKS AND DAM, WV & OH.	336,000	60,000	60,000
FC	LEVISA & TUG FORKS & UPPER CUMBERLAND RIVER, WV, KY, & VA.	468,000	42,400	43,400
FC	STONEWALL JACKSON LAKE, WV.	212,000	13,300	13,300
N	WINFIELD LOCK AND DAM, WV.	153,000	6,500	6,500
WISCONSIN				
FC	STATE ROAD AND EBNER COULEES, WI.	26,600	6,400	6,400

PROJECTS AVAILABLE FOR INITIATION OF CONSTRUCTION

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
CALIFORNIA				
FC	CACHE CREEK SETTLING BASIN, CA	15,600	3,250	3,250
FC	SANTA ANA RIVER MAINSTEM, CA	941,000	15,000	15,000
IOWA				
FC	RED ROCK DAM AND LAKE, IOWA (LAND AQUISITION)	28,400	0	1,500
NEW JERSEY				
FC	RAMAPO AND MAHWAH RIVERS, MAHWAH, NJ AND SUFFERN, NY	5,930	300	300
NEW MEXICO				
FC	MIDDLE RIO GRANDE PROTECTION, BERNALILLO TO BELEN, NM	36,400	0	2,000
NORTH DAKOTA				
FC	SHEYENNE RIVER, WEST FARGO AND RIVERSIDE, ND	45,200	2,700	2,700
PENNSYLVANIA				
FC	LOCK HAVEN, PA	56,500	1,000	1,000

CAPABILITIES FOR MAJOR REHABILITATION & DAM SAFETY ASSURANCE PROJECTS UNDERWAY

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
NORTH DAKOTA				
FC	LAKE ASHTABULA & BALDHILL DAM, SHEYENNE RVR, ND (DAM SAFETY)	36,100	1,000	1,000
OHIO				
FC	BOLIVAR DAM, MUSKINGUM RIVER LAKES, OH (DAM SAFETY)	7,400	3,200	3,200
SOUTH CAROLINA				
MP	COOPER RIVER SEISMIC MODIFICATION, SC	28,000	4,002	4,002
TEXAS				
FC	BUFFALO BAYOU & TRIBS-ADDICKS & BARKER DAMS, TX (DAM SAFETY)	10,900	1,429	1,429
WASHINGTON				
FC	MUD MOUNTAIN DAM, WA (DAM SAFETY)	43,800	1,200	1,200

CAPABILITIES FOR STUDIES UNDERWAY
MISSISSIPPI RIVER & TRIBUTARIES

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
ARKANSAS				
FDP	BOEUF & TENSAS RIVERS, AR & LA	6,625	575	575
FDP	EASTERN ARKANSAS REGION (COMPREHENSIVE STUDY), AR	2,620	280	280
LOUISIANA				
FDP	ATCHAFALAYA BASIN (WATER AND LAND RES), LA	6,563	54	54
MISSISSIPPI				
FDP	YAZOO RIVER BASIN MS	9,520	360	360
TENNESSEE				
FDP	REELFOOT LAKE, TN	1,320	270	270

STUDIES AVAILABLE FOR INITIATION
MISSISSIPPI RIVER & TRIBUTARIES

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
ARKANSAS				
FDP	ST FRANCIS BASIN BELOW WAPPAPELLO LAKE, AR & MO	3,213	0	125
MISSOURI				
FDP	BIRDS POINT - NEW MADRID FLOODWAY ALT. OPER	1,300	0	500

CAPABILITIES FOR CONTINUING PRECONSTRUCTION ENGINEERING & DESIGN MISSISSIPPI RIVER & TRIBUTARIES

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
ARKANSAS				
FC	LOWER WHITE RIVER (BIG CREEK AND TRIBS), AR	2,800	400	400
LOUISIANA				
FC	MISSISSIPPI & LOUISIANA ESTAURINE AREAS, LA & MS	3,500	715	715
MISSOURI				
FC	ST. JOHNS BAYOU AND NEW MADRID FLOODWAY, MO	3,300	350	350
TENNESSEE				
FC	HORN LAKE CREEK & TRIBS (INCL COW PEN CREEK), TN & MS	725	283	283

CAPABILITIES FOR INITIATION OF PRECONSTRUCTION ENGINEERING & DESIGN MISSISSIPPI RIVER & TRIBUTARIES

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
ARKANSAS				
FC	HELENA ARKANSAS AND VICINITY, AR	1,400	400	500
FC	WEST MEMPHIS ARKANSAS AND VICINITY, AR	950	300	500

CAPABILITIES FOR CONSTRUCTION PROJECTS UNDERWAY MISSISSIPPI RIVER & TRIBUTARIES

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
ARKANSAS				
FC	CACHE RIVER BASIN, AR	168,000	920	920
FC	CHANNEL IMPROVEMENT, AR, KY, IL, LA, MS, MO, & TN	3,075,000	94,900	94,900
FC	EIGHT MILE CREEK, AR	9,950	546	546
N	HELENA HARBOR, PHILLIPS COUNTY, AR	41,400	5,300	5,300
FC	L'ANGUILLE RIVER, AR	14,800	800	800
FC	MISSISSIPPI RIVER LEVEES, AR, IL, KY, LA, MS, MO, & TN	1,240,000	22,700	23,400
FC	ST FRANCIS BASIN, AR & MO	376,000	9,900	11,700
LOUISIANA				
FC	ATCHAFALAYA BASIN, FLOODWAY SYSTEM, LA	139,000	11,700	11,700
FC	ATCHAFALAYA BASIN, LA	1,460,000	31,000	31,000
FC	MISSISSIPPI DELTA REGION, LA	57,900	7,450	7,450
FC	TENSAS BASIN, RED RIVER BACKWATER AREA LA	166,600	5,758	5,758
FC	TENSAS BASIN, TENSAS-COCODRIE PUMPING PLANT, LA	55,500	842	842
MISSISSIPPI				
FC	YAZOO BASIN-BIG SUNFLOWER, MS	110,000	3,800	3,800
FC	YAZOO BASIN-DEMONSTRATION EROSION CONTROL, MS	45,000	17,725	17,725
FC	YAZOO BASIN-MAIN STEM, MS	157,000	1,200	1,200
FC	YAZOO BASIN-TRIBUTARIES, MS	236,000	4,300	4,300
FC	YAZOO BASIN-UPPER YAZOO PROJECTS, MS	369,597	5,465	5,465
FC	YAZOO BASIN-YAZOO BACKWATER, MS	262,000	110	110
TENNESSEE				
FC	WEST TENNESSEE TRIBUTARIES, TN	108,000	5,100	5,100

PROJECTS AVAILABLE FOR INITIATION OF CONSTRUCTION
MISSISSIPPI RIVER & TRIBUTARIES

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
TENNESSEE				
FC	NONCONNAH CREEK, TN & MS.	13,600	1,500	1,500

CAPABILITIES FOR MAJOR REHABILITATION & DAM SAFETY ASSURANCE PROJECTS UNDERWAY
MISSISSIPPI RIVER & TRIBUTARIES

(AMOUNTS IN THOUSANDS)

TYPE	PROJECT OR SURVEY	ESTIMATED FEDERAL COST	FY 89 APPROVED BUDGET	FY 89 CAPABILITY
MISSISSIPPI				
FC	SARDIS DAM, MS (DAM SAFETY ASSURANCE)...	7,400	600	600

CONTINUING AUTHORITIES PROGRAM

Senator JOHNSTON. Provide for the record a table showing your 1989 funding capability on each of the Small Projects, Continuing Authorities programs, by project.

General HATCH. The Continuing Authorities Program is budgeted on a programmatic basis rather than by project because it is so dynamic that we may be working on some projects in FY 1989 that we do not even know about at this time. For the same reason, we do not have capabilities for individual Continuing Authorities Projects. I can provide for the record a listing of projects which have received allocations as of 31 January 1988, or have been approved for construction but not yet funded, and the total amounts those projects are scheduled to receive in FY 1988 and FY 1989. As studies proceed and costs and benefits are determined, and local interests' willingness and ability to pay are determined, some activities will be terminated and others, not listed, may be initiated. Furthermore, we are managing each program to insure that only projects having predominately flood control and commercial navigation outputs proceed to construction.
(the information follows:)

ACTUAL AND PENDING ALLOCATION FOR SMALL PROJECTS PROGRAMS
(Funds Shown In $1,000)

	Fiscal Year	
Program/Category/Item	1988	1989
NAVIGATION (Section 107)		
Reconnaissance Studies	1,400	1,500
Detailed Project Reports		
Bass Harbor, Tremont, ME	65	40
Gloucester Harbor, Gloucester, MA	20	
Green Harbor, Marshfield, MA	60	14
Perkins Cove, Ogunquit, ME	20	
Pine Pt. Harbor, Scarborough, ME	30	
Point Judith Pond, RI	50	
Saugus River, Saugus, MA	10	
Scituate Harbor, Scituate, MA	40	
Winthrop Harbor, Winthrop, MA	65	10
Wood Island Harbor, ME	15	
Chignik, AK	15	
Larson Bay, AK	24	
Mountain Point, AK	43	
Ouzinkie, AK	100	
St. George, AK	70	
Henrici Bar Deep Draft Anchorage, OR	15	
Longview Deep Draft Anchorage, WA	8	
Willow Bar Deep Draft Anchorage, WA	9	
Yaquina Bay & Bar, OR	10	
Florence, AL	5	
Harkers Island, Carteret County, NC	16	
Avalon Harbor, CA	40	
Russellville-Dardanelle Port, AR	80	30
Projects Not Yet Identified	341	1,206
Subtotal Detailed Project Reports	1,150	1,300

ACTUAL AND PENDING ALLOCATION FOR SMALL PROJECTS PROGRAMS
(Funds Shown In $1,000)

Program/Category/Item	Fiscal Year 1988	Fiscal Year 1989
NAVIGATION (Section 107)		
Plans And Specifications		
Yellow Bend Port, AR	115	
Saxman, AK	270	195
Morgan Co., KY	265	
Kahului Harbor, Maui, HI	24	30
Cedar Island-Keaton Beach, FL	28	
Rockhouse Creek, FL	57	
Projects Not Yet Identified	1,191	1,875
Subtotal Plans And Specifications	1,950	2,100
Construction		
Bayou Grand Caillou, LA	1,090	
Southeast Missouri Port, MO	1,380	
Rudee Inlet, Virginia Beach, VA.	727	
Wachapreague Channel, Accomack Co., VA.	56	
Wilmington Harbor, DE	526	
Sturgeon Point, Evans, NY	800	322
Rockport Harbor, Rockport, MA	45	
Agat Harbor, Guam	410	
Laupahoehoe Harbor, HI	1,510	857
Brookgreen Gardens Canal, SC	43	
Projects Not Yet Identified	2,198	7,921
Subtotal Construction	8,785	9,100
Total Program (section 107)	13,285	14,000
MITIGATION FOR NAVIGATION PROJECTS (Section 111)		
Reconnaissance Studies	85	90
Detailed Project Reports		
Palm Beach Harbor, FL	40	
Projects Not Yet Identified	100	150
Subtotal Detailed Project Reports	140	150
Plans And Specifications		
Projects Not Yet Identified	80	100
Subtotal Plans And Specifications	80	80
Construction		
Herring Creek, St. Mary's County, MD	99	
Projects Not Yet Identified	99	180
Subtotal Construction	198	180
Total Program (Section 111)	503	500

ACTUAL AND PENDING ALLOCATION FOR SMALL PROJECTS PROGRAMS
(Funds Shown In $1,000)

Program/Category/Item	Fiscal Year 1988	Fiscal Year 1989
BEACH EROSION (Section 103)		
Reconnaissance Studies	550	400
Detailed Project Reports		
Prospect Beach, West Haven, CT	15	
Emeryville Point Park, CA	10	
Projects Not Yet Identified	175	200
Subtotal Detailed Project Reports	200	200
Plans And Specifications		
Lincoln Park, WA	115	
Sea Bluff Beach, West Haven, CT	50	
Projects Not Yet Identified	35	200
Subtotal Plans And Specifications	200	200
Construction		
Key Biscayne, FL	73	
Dunedin Bay Shoreline, FL	750	
Indian River Inlet-South Shore, DE	658	
Indian River Inlet-North Shore, DE	524	
Lake Erie, Lakeshore Park, Ashtabula, Ohio	25	25
Lake Michigan, Sunrise Ave, Lake Bluff, IL	139	
Projects Not Yet Identified	281	1,175
Subtotal Construction	2,450	1,200
Total Program (Section 103)	3,400	2,000
FLOOD CONTROL (Section 205)		
Reconnaissance Studies	5,400	4,700
Detailed Project Reports		
Bayou Natchitoches, LA	27	
Pearl-Flowood, MS	25	
Conklin, New York, Ice Jam Study	70	10
Gwynns Falls, Baltimore, MD	100	20
Great Chazy River; Champlain, NY	40	75
Hackensack River; New Milford, NJ	43	75
Valleyview, IL	12	
Tama, IA	58	
Aroostook R, Ft. Fairfield, ME	20	
Industrial Area, Waterbury, CT	70	
Mad R, Woodtick, Waterbury, CT	10	
Warrenton Diking District #1, OR	32	
Blacklick, Cr., Franklin Co., OH	140	
Duck Cr Elwood, IN	37	
Turpentine Run, St. Thomas, VI	100	100
Great Coharie Creek, Sampson Co., NC	35	
Lower Creek, Lenoir, NC	60	12
Peters Creek, Roanoke, VA	60	
Delaware Creek, Dallas Co., TX	59	
Ten Mile Creek, Duncanville, TX	66	

ACTUAL AND PENDING ALLOCATION FOR SMALL PROJECTS PROGRAMS
(Funds Shown In $1,000)

Program/Category/Item	Fiscal Year	
	1988	1989
FLOOD CONTROL (Section 205)		
Reconnaissance Studies	5,400	4,700
Detailed Project Reports		
West Gum Bayou, TX	37	
Projects Not Yet Identified	1,899	2,208
Subtotal Detailed Project Reports	3,000	2,500
Plans And Specifications		
Canal 43, AR	180	
Chauvin Bayou, LA	125	300
Youngs Bayou, LA	200	
Heart River, Mandan, ND	206	
Lodgepole Creek, Sidney, NE	104	
Yonkers, Nepera Park, NY	90	
Oelwein, IA	38	
Pontiac, IL	20	
Alvarado, ND	78	
Boscobel, WI - Sanders Creek	100	
Mad R, Woodtick, Waterbury, CT	120	
Point Of Pines, Revere, MA	175	
West River, New Haven, CT	40	
Winnipesaukee River Basin, NH	215	
Elwha Klallam Reservation, WA	140	
Garapan Area, NM	60	
Lake Suspe, NM	50	
Savan Gut, St. Thomas, VI	100	
Greens Creek, Petal, MS	120	
Tallahalla Creek, Laurel, MS	42	
Upper Gordons Creek, Hattiesburg, MS	128	
North Fork Gunnison River, Paonia, CO	12	
Mission Zanja Creek, CA	676	
Walnut Creek, Seguin, TX	70	
Projects Not Yet Identified	3,211	5,000
Subtotal Plans And Specifications	6,300	5,300
Construction		
Humboldt, TN	150	
Passaic River, NJ-NY Flood Emerg. Prep. System	847	
Pennypack Creek, Hatboro, PA	315	
Argyle, MN	800	
Henderson, MN	1,000	100
Beaver Brook, Keene, NH	45	
Riverdale, W. Springfield, MA	450	
Deschutes River, OR	26	
Oil Creek, Oil City, PA	2,253	
Rio Guanajibo, Sabana Grande, PR	1,415	
Savan Gut, St Thomas, VI	1,800	
Cribbs Mill, Tuscaloosa, AL	2,450	500
Eslava Creek, Mobile, AL	970	1,430
Stuart, VA	60	
Telegraph Canyon Creek, CA	3,300	
Lorean Branch, Hurst, TX	1,000	1,400

ACTUAL AND PENDING ALLOCATION FOR SMALL PROJECTS PROGRAMS
(Funds Shown In $1,000)

	Fiscal Year	
Program/Category/Item	1988	1989
FLOOD CONTROL (Section 205)		
Construction		
Kirbyville, TX	1,040	
Projects Not Yet Identified	2,144	14,070
Subtotal Construction	20,065	17,500
Total Program (Section 205)	34,765	30,000
EMERGENCY STREAMBANK AND SHORELINE PROTECTION (Section 14)		
Reconnaissance Studies	2,500	2,700
Plans And Specifications		
Chariton River, Schuyler Co., MO, Eason Branch	14	
Madison River, Quake Lake, MT (Highway 287)	12	
Milk River, Blaine Co., MT (Finley Branch)	9	
Platte River, Ginger Cove, NE	16	
Yellowstone River, Livingston, Mt (I-90)	12	
Hill's Point Road, Dorchester Co., MD	23	
Isle Of Wight Bay-Ocean City Bulkhead, MD	71	
Greenbrook Regional Center, Somerset, NJ	25	
Cuyahoga River, Brecksville Road, Independence, OH	1	
Lake Erie, Deist Road, Middlebass Island, OH	37	
Batavia, IL	8	
Dune Acres, IN	8	
Bar Lake, Manistee, MI	19	
Fairhaven, MI	24	
Harbor Springs, MI	33	
Jordan River, East Jordan, State Highway M32, MI	15	
Marysville, MI	30	
Milwaukee S. Shore Park, WI	13	
Muskegon, MI (Treatment Plant)	35	
Tawas City, MI	17	
Iowa Falls, IA	28	
Zumbro River, Genoa, MN	6	
Zumbro River, Jarrett, MN	20	
Little River, Belfast, ME	32	
Perley Brook, Ft. Kent, ME	25	
Sauk River, Skagit Co., WA	3	
S. Shenango Twp., PA	5	
Masefau Bay, AS	25	
Dan River, Madison WWTP, NC	13	
Pima Bridge, Safford, AZ	42	
Cat Claw Cr, Abilene, TX	27	
Projects Not Yet Identified	644	1,400
Subtotal Plans And Specifications	1,300	1,400

ACTUAL AND PENDING ALLOCATION FOR SMALL PROJECTS PROGRAMS
(Funds Shown In $1,000)

Program/Category/Item	Fiscal Year 1988	Fiscal Year 1989
EMERGENCY STREAMBANK AND SHORELINE PROTECTION (Section 14)		
Construction		
Logan Creek, Bancroft, NE	31	
Muckey Creek, Mapleton, IA	11	
Niobrara River, Bassett, NE	75	
Mississippi River, Lake Andrusia, MN	54	
Mill Brook, Brownsville, VT	12	
Little Quilcene River, WA	36	
Spokane River, WA	105	
Ft. Clinch State Park, FL	472	
Dan River, Madison WWTP, NC	161	
Spanish Creek, Quincy, CA	18	
City Of Marina Outfall, CA	40	
San Vicente Arroyo, Silver City, NM	81	
City Dam, Independence, KS	203	
Projects Not Yet Identified	3,191	6,100
Subtotal Construction	4,489	6,100
Total Program (Section 14)	8,289	10,200
SNAGGING AND CLEARING (Section 208)		
Reconnaissance Studies	450	200
Plans And Specifications		
Fish River, Baldwin County, AL	30	
Morrison, IL	8	
Lower Edwards River, IL	4	
Projects Not Yet Identified	58	50
Subtotal Plans And Specifications	100	50
Construction		
West Little Pine Creek, Etna, PA	150	
Projects Not Yet Identified	300	250
Subtotal Construction	450	250
Total Program (Section 208)	1,000	500

ANNUAL FLOOD DAMAGE REPORT

Senator JOHNSTON: Provide the record the annaual flood damage report, including a tabulation of the damages prevented by State.

General HEIBERG: Yes, sir.

[The information follows:]

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310

24 FEB 1988

Honorable J. Bennett Johnston
Chairman
Subcommittee on Energy and
  Water Development
Committee on Appropriations
United States Senate
Washington, D.C. 20510-1801

Dear Mr. Chairman:

This letter transmits the fifth Annual Flood Damage Report (enclosure), prepared in response to House Committee Report 98-217, Energy and Water Development Appropriation Act, 1984. The report provides information on a fiscal year basis and details flood damages, acres inundated, loss of life, and damages prevented by Army Corps of Engineers flood control measures. Assessments of damages resulting from other natural disasters also are given. All data are listed on a state-by-state basis. Flood damages prevented by Corps controlled projects are presented on a Corps District office basis in the "Annual Report of the Chief of Engineers on Civil Works Activities." Table 1 of this report is a summary of the annual damage data, while other tables present detailed information.

The Annual Flood Damage Report shows that both flood damages suffered and flood damages prevented in Fiscal Year 1987 were well below average. Preliminary estimates indicate $1.5 billion in flood damages occurred, about 60 percent of the ten-year (1977-1986) average of $2.5 billion. Estimates of average damages suffered or prevented are not adjusted for inflation. Flood related fatalities totaled 88 lives.

Weather phenomena, such as thunderstorms, hurricanes, tornadoes, tropical storms, major blizzards, and drought, caused 42 additional deaths. National economic losses from these phenomena are estimated to be an additional $640,000,000.

Dams, levees, and other flood control projects operated by the Corps of Engineers prevented $5.2 billion in flood damages. This total is about 50 percent of the ten-year (1977-1986) average of $10.3 billion. Corps projects were particularly effective in Oklahoma, Kansas, Arkansas, Missouri, Iowa, Illinois, Mississippi, Massachusetts, and Connecticut. When the largest flood of record struck the Arkansas and Osage River basins in late September 1986, and continued for about 2 weeks, flood control projects significantly reduced flooding, thus preventing about $2.0 billion in damages. Projects protecting the Lower Mississippi River Valley normally prevent billions of dollars in damages. For example, in Fiscal Year 1986, some $9.3 billion in damages were prevented. However, the lack of numerous major storms in areas controlled by these water projects limited benefits to less than $1 billion in Fiscal Year 1987.

From a national perspective, the benefits produced by Corps controlled projects are far in excess of the cost incurred to construct, operate, and maintain them. These projects are critically important to the well being of many people and to the economic welfare of the regions in which they are located.

In spite of the tremendous reduction in flood damages made by water control projects, many potential productive projects await construction. The benefits produced by projects underscore the need to continue the Federal and non-Federal partnership in the construction and operation of future flood control works. The charter for this partnership was set forth in Public Law 99-662, the Water Resources Development Act of 1986. While under that charter non-Federal sponsors will have to bear a substantial share of future project costs, the data in this report illustrate the productive power of sound water resources investment. That productivity provides the basis for non-Federal sponsors to fund their shares of the costs of future projects.

I am sending an identical letter to the Honorable Tom Bevill, Chairman, Subcommittee on Energy and Water Development, Committee on Appropriation, United States House of Representatives.

Sincerely,

SIGNED

Robert W. Page
Assistant Secretary of the Army
(Civil Works)

Enclosure

ARMY CORPS OF ENGINEERS
ANNUAL FLOOD DAMAGE REPORT
FOR FISCAL YEAR 1987

1. DAMAGES PREVENTED. During FY 87, Corps of Engineers projects and flood fight efforts prevented an estimated 5.2 billion in flood damages. Flood control projects, including dams, levees, and local protection projects, prevented $5.1 billion, and emergency operations prevented an additional $74,400,000. This is well below the 10-year (1977-1986) average of $10.3 billion. The record was set in FY 86 when $27.3 billion in flood damages were prevented. Estimates of damages prevented are not adjusted for inflation. Tables 1-4 summarize the FY 87 flood damages prevented. In FY 87, Corps flood control works were highly effective in preventing flood damages in parts of Oklahoma, Kansas, Arkansas, Missouri, Iowa, Illinois, Mississippi, Massachusetts, and Connecticut.

2. FLOOD DAMAGES PREVENTED BY CORPS PROJECTS AND EMERGENCY RESPONSE ACTIVITIES. The worst storm and flood of FY 87 occurred in the nations midsection from September 29, 1986 into the first two weeks of October. Remnants of Hurricane Payne carrying large amounts of moisture produced record amounts of precipitation over a wide area in northeastern Oklahoma, Missouri, Kansas, and adjacent states. As much as 22 inches of rain was measured over a 6-day period in some areas of Oklahoma. This amount represents as much as 230% of the previous record for a 6-day period.

In FY 87 Corps projects were particularly effective in the Arkansas, Osage and lower Missouri River basins where some of the heaviest amounts of precipitation occurred. For this storm, an estimated $2.0 billion in damages were prevented due to the beneficial regulation of reservoir projects. Reservoir regulation cut some river flows to a fraction of what they would have been without flood control projects. On the Verdigris River at Oologah, Oklahoma the stage was reduced by 22 feet. Many reservoirs were filled or overfilled by the storm. Without the benefit of reservoirs, this unusual flood would have sent high flows through Tulsa and Bartlesville, Oklahoma that would have been about twice the previous record high flows. Despite the positive effect of reservoirs, new record stages were set. For example, at Hermann, Missouri on the Missouri River the 1844 record stage was exceeded by 0.3 feet, but would have been much more without upstream flood control projects.

During a 9-day period from March 31 through April 8, 1987 a pair of intense rainstorms hit most of New England. These rains combined with mountain snowmelt resulted in the most widespread flooding in almost 50 years. Reservoir storage was wisely used and river flows reduced by as much as 50 percent. As a result, no significant flooding was experienced in areas located downstream of Corps reservoirs.

In FY 87 Corp-supported emergency activities, which were carried out under PL 84-99, prevented $74.4 million in damages. Some $28.7 million in damages that would have occurred from December and January storms were prevented by advance measures projects. The Corps emergency activities in Oklahoma and Arkansas prevented $42.2 million in damages in October 1986 when this area experienced record floods. Emergency repair of the West Tulsa levee resulted in minimal damage to Tulsa, Oklahoma. Major flooding occurred in May and June in the Pueblo, Colorado area, but because of emergency levees, $800,000 in damages were prevented.

3. Flood Damages Suffered. An estimated $1.5 billion in flood damages occurred in the U. S. and 88 lives lost due to flooding in FY 87. This is well below the 10-year average (1977-1986) of $2.5 billion and 138 lives, respectively. Flash Floods acccounted for over 75 percent of the death toll. At least 80 percent of those deaths took place in moving vehicles.

Flooding of some degree occurred in every region of the country with the most costly area being the Nation's midsection and the second most costly area being the Northeast corridor. These two regions accounted for over 85 percent of the annual losses and of that figure 48 percent of the loss occurred in metropolitan areas.

There were eight major flood events during FY 87. The first event was flooding in the Nation's midsection that began during the latter part of September and continued into the first 2 weeks of October. Flood waters receded in some areas and rose in others throughout this area as the flood wave moved downstream. Damages were estimated at over $400 million and five lives lost. In November, a Pacific frontal system stalled over western Washington drenching the area with up to 7 inches of rainfall in a 24-hour period. One life was lost and damages reached nearly $25 million. During the latter part of March and early April, an intense spring storm brought warm temperatures and heavy rains to the Northeast corridor which resulted in record flooding in that region. Fourteen lives were lost and damage estimates were over $20 million. Heavy rains of up to 17 inches near the end of May and early June once again brought record flooding to parts of the Nation's midsection. Record flooding was reported in parts of Iowa, Oklahoma, and Texas where damages were estimated at over $550 million and 13 lives were lost. During the first half of July, a nearly stationary storm system drenched parts of the Upper Midwest and the Ohio Valley with record rainfall that resulted in severe flooding. Losses were estimated at nearly $50 million and four lives were lost. On July 17, torrential rains from thunderstorms resulted in severe flooding along the headwaters of the Guadalupe River in Texas that caused nearly $1 million in damages with 10 lives lost. On August 12, a tropical depression that formed in the Gulf of Mexico moved in land along the Texas-Louisiana border. For the next several days it drenched the west Gulf Coast region with as much as 12 inches of rain. Severe flooding was reported throughout this region and losses were estimated at over $50 million but no lives were lost. The remnants from this depression moved into the Upper Midwest and drenched southern Wisconsin and northern Illinois with copious amounts of rainfall. Record flooding was reported on the Des Plaines river at Riverside, Illinois, and losses were estimated at over $100 million with four lives lost.

Table 1
Summary Estimates for Fiscal Year 1987
(In Millions of Dollars)

I. Flood Damages Prevented

Regions	Damages Prevented
New England	463.3
Mid-Atlantic	30.3
Gulf and South Atlantic	220.0
Ohio	172.9
Tennessee	4.4
Great Lakes	51.2
Upper Mississippi	430.6
Souris-Red-Rainy	52.0
Missouri	1,504.5
Arkansas-Red-White	996.6
Lower Mississippi	666.8
Rio Grande	113.6
Texas and Gulf	190.9
Colorado	0
Great Basin	0
California	154.9
Columbia-North Pacific	126.0
Alaska	17.0
Hawaii	.2
TOTAL	5,195.2

II. Major Floods and Damages Suffered*

Month	Location	Lives Lost	Damages Suffered
Oct 86	Middle America	5	400.0
Nov 86	Washington	1	25.0
Apr 87	Northeast	14	210.0
Jun 87	Middle America	13	550.0
Jul 87	Ohio Valley	4	50.0
Jul 87	Texas	10	1.0
Aug 87	Gulf Coast	0	50.0
Aug 87	Illinois	4	100.0
SUB TOTAL		51	1,386.0
TOTAL (ALL FLOODS IN U.S.)		88	1,500.0

III. OTHER MAJOR WEATHER EVENTS AND DAMAGES*

Event	Number	Lives Lost	Damages Suffered
Tropical Cyclone	5	0	0.0
Tornadoes	747	42	150.0
Tidal (Syzygy)	1	0	50.0
Drought	1	0	440.0
TOTAL	754	42	640.0

*Values from the National Weather Service

TABLE 2

FISCAL YEAR 1987
DISTRIBUTION BY STATE
FLOOD DAMAGES PREVENTED BY CORPS CONTROLLED PROJECTS
(In Thousands of Dollars)

STATE	
ALABAMA	0
ALASKA	17,000
ARIZONA	0
ARKANSAS	395,504
CALIFORNIA	154,858
COLORADO	642
CONNECTICUT	224,314
DELAWARE	0
FLORIDA	2,619
GEORGIA	4,220
HAWAII	220
IDAHO	623
ILLINOIS	260,336
INDIANA	14,257
IOWA	376,965
KANSAS	284,377
KENTUCKY	20,768
LOUISIANA	113,053
MAINE	7,605
MARYLAND	7,000
MASSACHUSETTS	203,457
MICHIGAN	2,828
MINNESOTA	5,888
MISSISSIPPI	226,975
MISSOURI	1,006,876
MONTANA	277
NEBRASKA	172,657
NEVADA	0
NEW HAMPSHIRE	14,397
NEW JERSEY	94
NEW MEXICO	97,900
NEW YORK	34,739
NORTH CAROLINA	94,430
NORTH DAKOTA	53,497
OHIO	80 044
OKLAHOMA	7[illegible] 329
OREGON	568
PENNSYLVANIA	[illegible] 971
PUERTO RICO	0
RHODE ISLAND	975
SOUTH CAROLINA	694
SOUTH DAKOTA	536
TENNESSEE	5,253
TEXAS	192,464
UTAH	0
VERMONT	6,295
VIRGINIA	124,709
WASHINGTON	86,774
WEST VIRGINIA	48,769
WISCONSIN	12
WYOMING	91
TOTAL	5,120,860

TABLE 3

FISCAL YEAR 1987
DISTRIBUTION BY STATE
FLOOD DAMAGES PREVENTED BY CORPS SUPPORTED EMERGENCY OPERATIONS
(In Thousands of Dollars)

STATE	
ALABAMA	0
ALASKA	0
ARIZONA	0
ARKANSAS	2,250
CALIFORNIA	0
COLORADO	800
CONNECTICUT	0
DELAWARE	0
FLORIDA	0
GEORGIA	0
HAWAII	0
IDAHO	0
ILLINOIS	2,050
INDIANA	0
IOWA	0
KANSAS	0
KENTUCKY	0
LOUISIANA	0
MAINE	0
MARYLAND	0
MASSACHUSETTS	0
MICHIGAN	28,524
MINNESOTA	0
MISSISSIPPI	0
MISSOURI	0
MONTANA	0
NEBRASKA	0
NEVADA	0
NEW HAMPSHIRE	0
NEW JERSEY	0
NEW MEXICO	0
NEW YORK	0
NORTH CAROLINA	0
NORTH DAKOTA	0
OHIO	216
OKLAHOMA	40,000
OREGON	0
PENNSYLVANIA	0
PUERTO RICO	0
RHODE ISLAND	0
SOUTH CAROLINA	0
SOUTH DAKOTA	0
TENNESSEE	0
TEXAS	0
UTAH	0
VERMONT	0
VIRGINIA	0
WASHINGTON	0
WEST VIRGINIA	500
WISCONSIN	12
WYOMING	0
TOTAL	74,352

TABLE 4

FISCAL YEAR 1987
DISTRIBUTION BY STATE
TOTAL FLOOD DAMAGES PREVENTED BY CORPS OF ENGINEERS
(In Thousands of Dollars)

STATE	
ALABAMA	0
ALASKA	17,000
ARIZONA	0
ARKANSAS	397,754
CALIFORNIA	154,858
COLORADO	1,442
CONNECTICUT	224,314
DELAWARE	0
FLORIDA	2,619
GEORGIA	4,220
HAWAII	220
IDAHO	623
ILLINOIS	262,386
INDIANA	14,257
IOWA	376,965
KANSAS	284,377
KENTUCKY	20,768
LOUISIANA	113,053
MAINE	7,605
MARYLAND	7,000
MASSACHUSETTS	203,457
MICHIGAN	31,352
MINNESOTA	5,888
MISSISSIPPI	226,975
MISSOURI	1,006,876
MONTANA	277
NEBRASKA	172,657
NEVADA	0
NEW HAMPSHIRE	14,397
NEW JERSEY	94
NEW MEXICO	97,900
NEW YORK	34,739
NORTH CAROLINA	94,430
NORTH DAKOTA	53,497
OHIO	80,260
OKLAHOMA	758,329
OREGON	38,568
PENNSYLVANIA	9,971
PUERTO RICO	0
RHODE ISLAND	9,975
SOUTH CAROLINA	694
SOUTH DAKOTA	536
TENNESSEE	5,253
TEXAS	192,464
UTAH	0
VERMONT	6,295
VIRGINIA	124,709
WASHINGTON	86,774
WEST VIRGINIA	49,269
WISCONSIN	24
WYOMING	91
TOTAL	5,195,212

Table 5

FISCAL YEAR 1987
FLOOD DAMAGES INCURRED
(DISTRIBUTION BY STATE)

State	Property ($000)	Acres Inundated (Thousands of Acres)	Lives Lost
Alabama	755	5	2
Alaska	20,000		1
Arizona	7		0
Arkansas	15,045	63	3
California	1,015		0
Colorado	*		0
Connecticut	5,000		0
Delaware	*		0
Florida	645	10	0
Georgia	1,470		4
Hawaii	2,050		2
Idaho	17		0
Illinois	150,000	30	4
Indiana	1,906	20	1
Iowa	16,755	137	0
Kansas	152,000	415	1
Kentucky	68		2
Louisiana	1,175		1
Maine	61,250	5	1
Maryland	51		1
Massachusetts	47,480	7	1
Michigan	15		0
Minnesota	27,800	3	2
Mississippi	6,380	15	0
Missouri	100,550	16	1
Montana	*		0
Nebraska	25,890	139	0
Nevada	13		0
New Hampshire	19,100	4	0
New Jersey	17,050	8	0
New Mexico	10		0
New York	75,275	15	12
North Carolina	20,461	5	0
North Dakota	4,943	30	0
Ohio	20,518	1	0
Oklahoma	22,250	6	4
Oregon	900		1
Pennsylvania	28		0
Rhode Island	550		0
South Carolina	31,771	4	0
South Dakota	3		0
Tennessee	95		4
Texas	546,515	5	29
Utah	250		0
Vermont	10,500		1
Virginia	1,510		6
Washington	30,150		1
West Virginia	125		0
Wisconsin	2,992		0
Wyoming	16		0
Puerto Rico	1,850		3

TOTALS
DEATHS: 88
Monetary Losses: $ 1.5 billion

* Property damage unavailable but flooding occurred

TABLE 6
FISCAL YEAR 1987
TORNADO LOSSES INCURRED ($000)

Annual Tornado Losses

State	Damages Incurred	No. of Tornadoes	Lives Lost
Alabama	2,500	8	1
Alaska	0	0	0
Arizona	1,875	5	0
Arkansas	335	5	0
California	3,005	10	0
Colorado	*	35	0
Connecticut	0	0	0
Delaware	0	0	0
Florida	3,146	70	1
Georgia	*	6	0
Hawaii	0	0	0
Idaho	1	1	0
Illinois	90	31	0
Indiana	10	20	0
Iowa	*	23	0
Kansas	4,300	31	0
Kentucky	50	8	0
Louisiana	1,450	15	0
Maine	0	0	0
Maryland	1	1	0
Massachusetts	0	0	0
Michigan	1,600	18	1
Minnesota	2,050	42	1
Mississippi	34,380	23	6
Missouri	120	10	0
Montana	1	1	0
Nebraska	325	23	0
Nevada	200	8	0
New Hampshire	0	0	0
New Jersey	*	6	0
New Mexico	1,600	14	0
New York	1,050	5	0
North Carolina	1,325	8	0
North Dakota	550	20	0
Ohio	*	10	0
Oklahoma	5,173	19	0
Oregon	0	0	0
Pennsylvania	1,475	5	0
Rhode Island	0	0	0
South Carolina	50	2	0
South Dakota	1,156	56	0
Tennessee	1	1	0
Texas	8,376	145	32
Utah	2	3	0
Vermont	5	1	0
Virginia	3,510	11	0
West Virginia	175	6	0
Wisconsin	1,025	25	0

TOTAL EVENTS: 747
DEATHS: 42
Monetary Losses: less than $150 million

* Property damage unavailable

Senator JOHNSTON: Could you provide for the record a table which shows the expected budget planning targets for the ongoing program during the out years, identifying the total annual appropriation level needed to complete and operate those activities included in the 1988 bill and those new commitments in the 1989 request?

Mr. PAGE: I will provide that information for the record.

[The information follows:]

SUMMARY - FUNDING ESTIMATES FOR ONGOING PROGRAM (FY1988 - FY1993) [LRFNDGCW]
U.S. ARMY CIVIL WORKS PROGRAM

INDIVIDUAL APPROPRIATION ACCOUNT	FUNDING ESTIMATES (Rounded Dollar Amounts in Thousands)					
	FY 1988	FY 1989	FY 1990	FY 1991	FY 1992	FY 1993
GENERAL INVESTIGATIONS	139,000	129,000	114,000	94,000	79,000	64,000
CONSTRUCTION, GENERAL	1,200,000	1,228,000	1,228,000	1,050,000	806,000	585,000
OPERATION & MAINTENANCE, GENERAL	1,400,000	1,373,000	1,394,000	1,456,000	1,470,000	1,481,000
FC,MISSISSIPPI RIVER & TRIBUTARIES	318,000	334,000	336,000	346,000	356,000	350,000
GENERAL EXPENSES	115,000	123,000	126,000	127,000	129,000	131,000
REGULATORY PROGRAM	55,000	61,000	62,000	62,000	62,000	62,000
REMAINING APPROPRIATION ACCOUNTS						
A. Flood Control & Coastal Emergencies	20,000	25,000	26,000	27,000	28,000	29,000
B. Plant Replacement & Improvement Program	0	35,000	53,000	19,000		
C. Permanent Appropriations	9,000	9,000	10,000	10,000	11,000	11,000
Subtotal - Remaining Accounts	29,000	69,000	89,000	56,000	39,000	40,000
GRAND TOTAL - CIVIL WORKS ONGOING PROGRAM	3,256,000	3,317,000	3,349,000	3,191,000	2,941,000	2,713,000

NOTES PER ACCOUNT:

GI - Without any new reconnaissance phase studies both the Survey & PED programs essentially zero out by FY93. Thereafter, the programmatic allowance for the other activities and line items normally funded under this account would govern.

CG - Reflects construction schedule (with inflation) for ongoing projects and budgeted FY89 new starts plus a programmatic allowance for those other activities and line items normally funded under this account.

O/M - Protection of Navigation and Emergency Preparedness Programs funded at their FY 89 level; all the other programs and activities adjusted for inflation. Also phased in was an allowance for those projects -- navigation and reservoirs-- currently under construction that would be operated and maintained by the Corps at Federal expense.

MR/T- The long range funding estimates for the ongoing program include inflation allowance for the construction program.

ALL - The labor components for all accounts have been constrained and do not relect allowances for ingrade adjustments nor salary raises beyond that approved for FY 1988.

Senator JOHNSTON: Please provide for the record a table similar to the one provided last year which shows the multiple year construction program funding and obligation ceiling.

General HEIBERG: Yes, sir.

MULTIPLE YEAR CONSTRUCTION PROGRAM (FY 1988 - FY 1993)
U.S. ARMY CIVIL WORKS PROGRAM

FUNDING SCHEDULE AND OBLIGATION CEILINGS

	Multiple Year Estimates (In Thousands of Dollars) [1]						
Programs and Activities	FY 1988	FY 1989	FY 1990	FY 1991	FY 1992	FY 1993	SCHED BAL
CONSTRUCTION PROGRAM (Budget Auth. (BA))							[2]
1.Construction, General Account [3]							
Ongoing Base Program(Incl FY85&87 NS)	1,341,004	1,238,836	1,118,016	841,731	580,903	364,504	826,384
FY 1988 New Starts	21,376	84,816	114,923	94,032	77,000	59,057	76,066
FY 1989 New Start Programs							
Proj. Constr.		22,250	79,650	123,209	120,150	109,358	538,509
Other Programs & New Work [4]		0	15,000	78,554	130,007	119,490	N/A
Subtotal, FY 1989 New Starts		22,250	94,650	201,763	250,157	228,848	
Savings & Slippage	(162,205)	(118,332)	(112,798)	(49,391)	(32,667)	(25,731)	
FY 1989 Progr.(Net Fed.Approp)	1,200,175	1,227,570	1,214,791	1,088,135	875,393	626,678	
2.M R & T Construction Component							
Ongoing Base Program(Incl FY85&87 NS)	213,547	224,016	220,756	226,239	233,146	218,534	2,857,474
FY 1988 New Starts	1,728	6,100	6,600	7,959	1,100	1,400	5,988
FY 1989 New Starts		1,500	5,200	1,400	1,800	1,823	207
Savings & Slippage	(14,255)	(12,428)	(11,473)	(10,054)	(9,082)	(8,005)	
FY 1989 Progr.(Net Fed.Approp)	201,020	219,188	221,083	225,544	226,964	213,752	
3.Total Construction Program (CG & MR&T)							
Ongoing Base Program(Incl FY85&87 NS)	1,554,551	1,462,852	1,338,772	1,067,970	814,049	583,038	3,683,858
FY 1988 New Starts	23,104	90,916	121,523	101,991	78,100	60,457	82,054
FY 1989 New Starts	0	23,750	99,850	203,163	251,957	230,671	538,716
Savings & Slippage	(176,460)	(130,760)	(124,271)	(59,445)	(41,749)	(33,736)	
Total Budget Auth.(Net Fed.Approp)	1,401,195	1,446,758	1,435,874	1,313,679	1,102,357	840,430	
CONSTRUCTION PROGRAM (Budget Outlay(BO))	[5]						
1.Construction, General Account	1,141,809	1,226,373	1,214,791	1,088,135	875,393	626,678	
2.M R & T Construction Component	204,586	220,029	221,083	225,544	226,964	213,752	
3.Total Construction Program (CG & MR&T)	1,346,395	1,446,402	1,435,874	1,313,679	1,102,357	840,430	
OBLIGATION CEILINGS (PL 99-662)	1,400,000	1,500,000	1,600,000	1,700,000	1,800,000	N/A	N/A

[1] Funding estimates are for the ongoing construction program and the FY 1989 budgeted new starts only.

[2] Reflects funding for specifically authorized projects only.

[3] Includes funds from the Inland Waterways Trust Fund.

[4] Includes addition to program for: (a) the recovery of S&S applied to projects in previous years; (b) projects, separable elements, or project features currently scheduled as the next phase of work; and (c) allowances for the dam safety and resumption programs.

[5] Estimates for FY 1988 and FY 1989 reflect FY 1988 Bipartisan Budget Agreement; estimates for FY 1990 - FY 1993 assume that the unobligated carryover remains constant.

BALANCE-TO-COMPLETE REPORT

Senator JOHNSTON. Please provide for the record the detailed summary of projects (Balance-to-complete Report) similar to that submitted to the House Energy and Water subcommittee last year.

General HEIBERG. Yes, sir.

As of 18 February 1988

CORPS OF ENGINEERS - CIVIL WORKS
SUMMARY OF PRECONSTRUCTION ENGINEERING & DESIGN (PED)
AUTHORIZED PROJECTS
(Thousands of Dollars)

	No. of Proj.	Est. Federal Cost	Allocations Thru FY 1988	Budget FY 1989	Balance to Complete	
					Scheduled	Unscheduled
PROJECTS IN FY 1989 BUDGET:						
PED New Starts	4	85767	2640	1250	3310	78567
Flood Control	4	85767	2640	1250	3310	78567
Continuing PED	69	1718186	71799	29337	26887	1590163
Navigation	17	364094	12750	5227	2455	343662
Beach Erosion Control	6	91332	5621	2464	3400	79847
Flood Control	45	1223760	52716	21246	19344	1130454
MR&T Feature	1	39000	712	400	1688	36200
Total	73	1803953	74439	30587	30197	1668730
PROJECTS NOT IN BUDGET:						
PED Not Started	64	1912882	0	0	0	1912882
Navigation	18	711213	0	0	0	711213
Beach Erosion Control	12	222834	0	0	0	222834
Flood Control	28	229335	0	0	0	229335
Multiple Purpose	6	749500	0	0	0	749500
PED Not Completed	38	3891754	59504	0	0	3832250
Navigation	11	2125451	15855	0	0	2109596
Beach Erosion Control	4	201384	1310	0	0	200074
Flood Control	21	1468419	41472	0	0	1426947
Multiple Purpose	1	40600	617	0	0	39983
MR&T Feature	1	55900	250	0	0	55650
PED Fully Funded	16	1194566	39498	0	0	1155068
Navigation	7	119517	5600	0	0	113917
Beach Erosion Control	1	11100	300	0	0	10800
Flood Control	5	964374	29258	0	0	935116
Multiple Purpose	3	99575	4340	0	0	95235
Total	118	6999202	99002	0	0	6900200
GRAND TOTAL	191	8803155	173441	30587	30197	8568930

CORPS OF ENGINEERS - CIVIL WORKS
SUMMARY OF CONSTRUCTION PROJECTS
(Thousands of Dollars)

	No. of Proj.	Est. Federal Cost	Allocations Thru FY 1988	Budget FY 1989	Balance to Complete	
					Scheduled	Unscheduled
PROJECTS IN FY 1989 BUDGET:						
Construction New Starts	6	1079830	25889	23750	981306	48885
Flood Control	5	1066230	24489	22250	970876	48615
MR&T Feature	1	13600	1400	1500	10430	270
Continuing Construction	165	26235593	13793575	1463115	7684575	3294328
Navigation	39	6889177	3025322	543009	1536882	1783964
Beach Erosion Control	10	376689	57381	22459	278193	18656
Flood Control	97	7980677	4478665	602541	1869776	1029695
Multiple Purpose	6	2507000	2287398	65590	115475	38537
MR&T Features	13	8482050	3944809	229516	3884249	423476
Dam Safety Assurance	6	133600	48828	11431	73341	0
Flood Control	4	98200	18790	6829	72581	0
Multiple Purpose	1	28000	23998	4002	0	0
MR&T Feature	1	7400	6040	600	760	0
Total	177	27449023	13868292	1498296	8739222	3343213
PROJECTS NOT IN BUDGET:						
Construction	131	6745414	4835214	0	0	1910200
Navigation	37	2827205	2425073	0	0	402132
Beach Erosion Control	14	337510	54199	0	0	283311
Flood Control	69	2750849	1639190	0	0	1111659
Multiple Purpose	6	746100	673759	0	0	72341
MR&T Features	5	83750	42993	0	0	40757
Major Rehabilitation	1	22048	22048	0	0	0
Flood Control	1	22048	22048	0	0	0
Dam Safety Assurance	1	8500	7465	0	0	1035
Flood Control	1	8500	7465	0	0	1035
Total	133	6775962	4864727	0	0	1911235
GRAND TOTAL	310	34224985	18733019	1498296	8739222	5254448

CORPS OF ENGINEERS - CIVIL WORKS
SUMMARY - ALL AUTHORIZED PROJECTS
(Thousands of Dollars)

	No. of Proj.	Est. Federal Cost	Allocations Thru FY 1988	Budget FY 1989	Balance to Complete	
					Scheduled	Unscheduled
ACTIVE PROJECTS:						
Preconstruction Engineering & Design (Auth. Projects)	191	8803155	173441	30587	30197	8568930
Construction Projects	310	34224985	18733019	1498296	8739222	5254448
Total	501	43028140	18906460	1528883	8769419	13823378
DEFERRED PROJECTS	107	4253851	169912	0	0	4083939
(MR&T Features)	(4)	(204591)	(26635)	(0)	(0)	(177956)
INACTIVE PROJECTS	203	4864553	382861	0	0	4481692
(MR&T Features)	(1)	(20400)	(5140)	(0)	(0)	(15260)

KEY TO DIVISION/DISTRICT ABBREVIATIONS

LMV	Lower Mississippi Valley Division
LMM	Memphis District
LMN	New Orleans District
LMS	St. Louis District
LMK	Vicksburg District
MRD	Missouri River Division
MRK	Kansas City District
MRO	Omaha District
NED	New England Division
NAD	North Atlantic Division
NAB	Baltimore District
NAN	New York District
NAO	Norfolk District
NAP	Philadelphia District
NCD	North Central Division
NCB	Buffalo District
NCC	Chicago District
NCE	Detroit District
NCR	Rock Island District
NCS	St. Paul District
NPD	North Pacific Division
NPA	Alaska District
NPP	Portland District
NPS	Seattle District
NPW	Walla Walla District
ORD	Ohio River Division
ORH	Huntington District
ORL	Louisville District
ORN	Nashville District
ORP	Pittsburgh District
POD	Pacific Ocean Division
SAD	South Atlantic Division
SAC	Charleston District
SAJ	Jacksonville District
SAM	Mobile District
SAS	Savannah District
SAW	Wilmington District
SPD	South Pacific Division
SPL	Los Angeles District
SPK	Sacramento District
SPN	San Francisco District
SWD	Southwestern Division
SWA	Albuquerque District
SWF	Fort Worth District
SWG	Galveston District
SWL	Little Rock District
SWT	Tulsa District

PRECONSTRUCTION ENGINEERING AND DESIGN IN FY 89 BUDGET (AUTH PROJECTS)
PED NEW STARTS (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL							
SPK	NAPA RIVER, CA	59,600	4,000	2,640	550	810	55,600
NAN	MOLLY ANN'S BROOK, NJ	17,370	1,900	0	250	1,650	15,470
SWA	ABIQUIU DAM (EMERGENCY GATES), NM	2,700	200	0	150	50	2,500
ORP	SAW MILL RUN, PITTSBURGH, PA	6,097	1,100	0	300	800	4,997
	TOTALS	85,767	7,200	2,640	1,250	3,310	78,567
	NO. OF PROJECTS	4					
	GRAND TOTALS	85,767	7,200	2,640	1,250	3,310	78,567
	NO. OF PROJECTS	4					

PRECONSTRUCTION ENGINEERING AND DESIGN IN FY 89 BUDGET (AUTH PROJECTS)
CONTINUING PED (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
BEACH EROSION							
SAM	PANAMA CITY BEACHES,FL	24,300	3,500	600	250	2,650	20,800
SAJ	SARASOTA COUNTY,FL	6,022	375	200	175	0	5,647
SAJ	ST JOHNS COUNTY, FL	11,100	350	280	70	0	10,750
NAB	ATLANTIC COAST OF MD AND ASSATEAGUE ISLAND, VA	16,200	2,600	1,891	709	0	13,600
NAN	ATLANTIC COAST OF NEW YORK CITY (CONEY ISLAND), NY	7,910	1,800	450	600	750	6,110
NAO	VIRGINIA BEACH, VA (HURRICANE PROTECTION)	25,800	2,860	2,200	660	0	22,940
	TOTALS	91,332	11,485	5,621	2,464	3,400	79,847
	NO. OF PROJECTS	6					
FLOOD CONTROL							
SPL	HOLBROOK, AZ	7,800	1,350	1,130	220	0	6,450
SPL	RILLITO, AZ	12,300	1,340	450	290	600	10,960
SPK	CACHE CREEK BASIN (OUTLET CHANNEL), CA	10,900	1,950	1,700	250	0	8,950
SPK	GUADALUPE RIVER, CA	18,500	2,000	1,389	611	0	16,500
NAB	WASHINGTON, DC & VICINITY	11,700	2,300	1,557	470	273	9,400
POD	ALENAIO STREAM, HI	4,850	750	300	200	250	4,100
NCR	LOVES PARK, IL	15,300	1,300	1,091	209	0	14,000
NCC	O'HARE RESERVOIR, IL	13,900	850	485	365	0	13,050
NCC	LITTLE CALUMET RIVER, IN	56,600	1,815	1,575	240	0	54,785
NCR	MUSCATINE ISLAND LEVEE & DRAINAGE DISTRICT, IA	4,830	400	250	150	0	4,430
MRO	PERRY CREEK, IA	29,100	1,080	788	187	105	28,020

PRECONSTRUCTION ENGINEERING AND DESIGN IN FY 89 BUDGET (AUTH PROJECTS)
CONTINUING PED (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL							
NCR	WEST DES MOINES-DES MOINES, IA	11,600	1,100	325	250	525	10,500
SWT	DOUGLASS LAKE, KS	44,500	3,100	904	750	1,446	41,400
SWT	UPPER LITTLE ARKANSAS RIVER WATERSHED, KS	9,600	650	250	200	200	8,950
ORL	FRANKFORT (SOUTH FRANKFORT), KY	5,958	1,217	842	175	200	4,741
LMN	WESTWEGO TO HARVEY CANAL, LA	42,600	1,600	1,000	600	0	41,000
NED	MASSACHUSETTS COASTAL, ROUGHANS POINT, REVERE, MA	6,110	1,000	705	295	0	5,110
NCS	MISSISSIPPI RIVER AT ST. PAUL, MN	6,660	1,100	400	350	350	5,560
NCS	ROOT RIVER AT HOUSTON, MN	7,060	1,000	497	260	243	6,060
LMK	PEARL RIVER, SHOCCOE DAM, MS	49,800	3,500	2,218	600	682	46,300
MRK	BRUSH CREEK, KANSAS CITY, MO	13,100	1,700	1,310	390	0	11,400
LMS	CAPE GIRARDEAU - JACKSON METRO AREA, MO	19,650	2,700	1,510	600	590	16,950
LMS	MALINE CREEK, MO	38,950	4,200	1,476	600	2,124	34,750
NAN	LOWER SADDLE RIVER, NJ	27,600	3,900	500	750	2,650	23,700
NAN	RAMAPO RIVER AT OAKLAND, NJ	5,790	1,300	250	470	580	4,490
NAN	RARITAN RIVER BASIN, GREEN BROOK SUB-BASIN, NJ	56,700	5,300	3,196	1,500	604	51,400
SWA	RIO GRANDE FLOODWAY, SAN ACACIA TO BOSQUE DEL APACHE, NM	25,200	1,390	740	450	200	23,810
NAN	WESTCHESTER CO STREAMS, MAMARONECK & SHELDRAKE RIVERS, NY	43,000	3,000	2,910	90	0	40,000
NAN	WESTCHESTER CO STREAMS, TOWN OF MAMARONECK, NY	2,520	600	75	250	275	1,920
SAW	BRUNSWICK COUNTY, NC	31,800	300	150	150	0	31,500

PRECONSTRUCTION ENGINEERING AND DESIGN IN FY 89 BUDGET (AUTH PROJECTS)
CONTINUING PED (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	UNSCHEDULED
FLOOD CONTROL							
ORL	FAIRFIELD, OH	8,909	1,209	1,059	150	0	7,700
ORH	LOGAN, OH	6,255	1,126	826	300	0	5,129
ORH	NELSONVILLE, OH	7,053	1,316	961	355	0	5,737
ORH	NORTH CHILLICOTHE, SCIOTO RIVER, OH	8,730	1,350	550	600	200	7,380
SWT	FRY CREEKS, BIXBY, OK	10,200	1,300	330	500	470	8,900
NAP	PROMPTON LAKE, PA (MOD)	3,900	3,900	2,653	1,000	247	0
NAB	SUSQUEHANNA BASIN AT HARRISBURG, PA	56,700	4,600	3,578	540	482	52,100
NAB	WYOMING VALLEY LEVEE RAISING, PA	122,000	7,700	3,242	1,550	2,908	114,300
SAJ	RIO PUERTO NUEVO, PR	157,000	6,000	2,275	1,700	2,025	151,000
SWF	BEALS CREEK, BIG SPRING, TX	5,360	676	351	150	175	4,684
SWG	SIMS BAYOU, HOUSTON, TX	97,100	2,300	1,845	455	0	94,800
SWG	UPPER WHITE OAK BAYOU & TRIBUTARIES, VICINITY OF HOUSTON, TX	70,200	3,700	3,291	409	0	66,500
SAW	ROANOKE RIVER UPPER BASIN, VA, HEADWATERS AREA	13,800	1,515	1,050	465	0	12,285
NPS	CENTRALIA, WA	15,750	1,740	150	650	940	14,010
NPW	ZINTEL CANYON DAM, WA	6,825	1,082	582	500	0	5,743
	TOTALS NO. OF PROJECTS	1,223,760 45	93,306	52,716	21,246	19,344	1,130,454
NAVIGATION							
NPA	KODIAK HARBOR, AK	12,400	918	50	475	393	11,482
SPN	NOYO RIVER AND HARBOR (BREAKWATER), CA	6,700	1,560	1,223	200	137	5,140
SAJ	HUDSON RIVER, FL	1,800	200	0	200	0	1,600

PRECONSTRUCTION ENGINEERING AND DESIGN IN FY 89 BUDGET (AUTH PROJECTS)
CONTINUING PED (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	UNSCHEDULED
	NAVIGATION						
SAJ	MIAMI HARBOR CLEANUP, FL	5,850	400	0	100	300	5,450
POD	KAWAIHAE SMALL BOAT HARBOR, HI	2,730	328	83	157	88	2,402
POD	MAALAEA HARBOR, MAUI, HI	5,380	405	195	210	0	4,975
NCE	DULUTH - SUPERIOR HARBOR, MN & WI	6,909	746	446	150	150	6,163
SAM	GULFPORT HARBOR, MS	63,300	2,000	1,769	231	0	61,300
SAM	PASCAGOULA HARBOR, MS	36,615	1,135	875	260	0	35,480
NAN	NEW YORK HBR & ADJ CHANNELS, PORT JERSEY, NJ	8,040	1,400	300	500	600	6,640
NAN	GOWANUS CREEK CHANNEL, NY	2,540	500	150	200	150	2,040
NCB	OLCOTT HARBOR, NY	6,530	1,100	350	350	400	5,430
SAW	WILMINGTON HARBOR - NORTHEAST (CAPE FEAR) RIVER, NC	7,700	680	505	175	0	7,020
NCB	LORAIN HARBOR, OH	3,310	460	324	136	0	2,850
SWG	BRAZOS ISLAND HARBOR, TX (42-FOOT PROJECT)	20,800	1,230	593	400	237	19,570
SWG	TEXAS CITY CHANNEL, TX (50-FOOT PROJECT)	108,400	2,000	1,587	413	0	106,400
NPS	GRAYS HARBOR, CHEHALIS & HOQUIAM RIVER, WA	65,090	5,370	4,300	1,070	0	59,720
	TOTALS	364,094	20,432	12,750	5,227	2,455	343,662
	NO. OF PROJECTS	17					
	GRAND TOTALS	1,679,186	125,223	71,087	28,937	25,199	1,553,963
	NO. OF PROJECTS	68					

MISSISSIPPI RIVER AND TRIBUTARIES
PRECONSTRUCTION ENGINEERING AND DESIGN IN FY 89 BUDGET (AUTH PROJECTS)
CONTINUING PED (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL							
LMM	LOWER WHITE RIVER (BIG CREEK AND TRIBS), AR.	39,000	2,800	712	400	1,688	36,200
	TOTALS	39,000	2,800	712	400	1,688	36,200
	NO. OF PROJECTS	1					
	GRAND TOTALS	39,000	2,800	712	400	1,688	36,200
	NO. OF PROJECTS	1					

PRECONSTRUCTION ENGINEERING AND DESIGN NOT IN FY 89 BUDGET (AUTH PROJECTS)
PED NOT STARTED (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
	BEACH EROSION						
SAJ	CHARLOTTE COUNTY, FL	2,220	200	0	0	0	2,220
NCC	CASINO BEACH,IL	2,710	550	0	0	0	2,710
NCC	ILLINOIS BEACH STATE PARK, IL	4,283	700	0	0	0	4,283
NAP	ABSECON ISLAND, NJ (GROUP III)	45,951	650	0	0	0	45,951
NAP	BRIGANTINE ISLAND, NJ (GROUP III)	13,900	338	0	0	0	13,900
NAP	CAPE MAY POINT, NJ (GROUP II)	3,290	237	0	0	0	3,290
NAP	HEREFORD INLET AND FIVE MILE BEACH, NJ (GROUP II)	28,900	1,240	0	0	0	28,900
NAP	LONG BEACH ISLAND, NJ (GROUP III)	33,500	359	0	0	0	33,500
NAP	TOWNSEND INLET & SEVEN MI BE, NJ (GROUP I)	78,400	500	0	0	0	78,400
NCB	FORT NIAGARA STATE PARK SEC 201 AUTH 1970	2,980	460	0	0	0	2,980
SAW	FORT FISHER, NC SEC 201, 1976	3,250	645	0	0	0	3,250
NAO	WILLOUGHBY SPIT, VA (BEACH EROSION) (PED)	3,470	650	0	0	0	3,470
	TOTALS NO. OF PROJECTS	222,834 12	6,729	0	0	0	222,834
	FLOOD CONTROL						
NAN	WESTCHESTER CO STREAMS, BYRAM RIVER, CT	1,350	1,350	0	0	0	1,350
NPW	LITTLE WOOD RIVER, GOODING/SHOSHONE, ID	3,550	500	0	0	0	3,550
NCC	WILMINGTON ICE CONTROL DEMONSTRATION	3,000	300	0	0	0	3,000
NCC	LAKE GEORGE, HOBART, IN	3,750	200	0	0	0	3,750
NCC	LITTLE CALUMET RIVER BASIN (CADY MARSH DITCH), IN	3,770	550	0	0	0	3,770

PRECONSTRUCTION ENGINEERING AND DESIGN NOT IN FY 89 BUDGET (AUTH PROJECTS)
PED NOT STARTED (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL							
NCR	GREEN BAY L+DD #2, IA	5,270	700	0	0	0	5,270
MRO	THURMAN TO HAMBURG, IA PUMPING FACILITIES (WRDA, 1986)	900	100	0	0	0	900
SWT	ARKANSAS CITY,KS	11,200	900	0	0	0	11,200
SWT	PEARSON-SKUBITZ BIG HILL LAKE, (ACCESS ROAD), KS	2,000	250	0	0	0	2,000
ORN	CELINA LAKE, KY & IN	2,000	2,000	0	0	0	2,000
ORH	FISHTRAP LAKE, KY (PURCHASE PROPERTY AND RELOCATE-1986 ACT)	550	550	0	0	0	550
ORL	LOUISVILLE, KY	300	300	0	0	0	300
ORH	OHIO RIVER AND TRIBUTARIES (STREAMBANK EROSION PROTECTION)	5,000	5,000	0	0	0	5,000
NCR	ALBERT LEA LAKE,MN	130	130	0	0	0	130
NCR	SCHUYLER COUNTY,MO	50	50	0	0	0	50
LMS	STE. GENEVIEVE, MISSOURI	31,800	3,300	0	0	0	31,800
NAN	ROBINSON'S BRANCH, CLARK AND SCOTCH PLAINS, NJ	570	570	0	0	0	570
NAN	SOUTH ELLENVILLE, NY	7,060	1,380	0	0	0	7,060
SAW	SUGAR CREEK BASIN, NC & SC	19,500	1,637	0	0	0	19,500
NCS	GRAFTON, ND	14,750	1,000	0	0	0	14,750
NAB	MILTON, PA	25,000	1,250	0	0	0	25,000
ORH	MUSKINGUM RIVER, MANSFIELD, OHIO	3,000	450	0	0	0	3,000
NPW	MALHEUR AND HARNEY LAKES OR.	4,000	300	0	0	0	4,000
NED	BIG RIVER RESERVOIR, RI	4,945	3,000	0	0	0	4,945

PRECONSTRUCTION ENGINEERING AND DESIGN NOT IN FY 89 BUDGET (AUTH PROJECTS)
PED NOT STARTED (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
	FLOOD CONTROL						
NED	TOWNSHEND LAKE AND BALL MOUNTAIN DAMS, VT	1,000	100	0	0	0	1,000
ORH	CABIN CREEK, WEST VIRGINIA	5,265	800	0	0	0	5,265
ORH	ISLAND CREEK BASIN IN AND AROUND LOGAN, WEST VIRGINIA	64,625	2,300	0	0	0	64,625
NCS	WISCONSIN RIVER AT PORTAGE, WI	5,000	825	0	0	0	5,000
	TOTALS	229,335	29,792	0	0	0	229,335
	NO. OF PROJECTS	28					
	MULTIPLE PURPOSE						
NPA	ALLISON LAKE, AK (VALDEZ HYDROPOWER)	45,000	1,800	0	0	0	45,000
NPA	SLAMMON BAY, AK (HYDROPOWER)	1,700	115	0	0	0	1,700
SWL	DARDANELLE LOCK AND DAM, AR, CANE CREEK BRIDGE REPLACEMENT	1,000	240	0	0	0	1,000
NPP	BLUE RIVER POWERHOUSE, OR (HYDROPOWER)	32,200	2,160	0	0	0	32,200
NPW	MCNARY SECOND POWERHOUSE, OR & WA	667,000	6,671	0	0	0	667,000
MRO	SPRINGFIELD WATER INTAKE, SD	2,600	200	0	0	0	2,600
	TOTALS	749,500	11,186	0	0	0	749,500
	NO. OF PROJECTS	6					
	NAVIGATION						
POD	HILO HARBOR, HI (1986 WRDA)	2,140	560	0	0	0	2,140
POD	KIKIAOLA SMALL BOAT HARBOR, KAUAI, HI	1,950	300	0	0	0	1,950
MRK	MISSOURI RIVER F&W MITIGATION, IA, NE, KS & MO	51,859	675	0	0	0	51,859
NAB	OCEAN CITY HARBOR, INLET & SINEPUXENT BAY, MD	1,020	185	0	0	0	1,020

PRECONSTRUCTION ENGINEERING AND DESIGN NOT IN FY 89 BUDGET (AUTH PROJECTS)
PED NOT STARTED (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
NAVIGATION							
NCE	GRAND HAVEN HARBOR MICH.	10,709	800	0	0	0	10,709
NCE	GREAT LAKES CONNECTING CHANNELS & HBRS RREPLACEMENT LOCK	156,000	8,600	0	0	0	156,000
NCE	GREAT LAKES CONNECTING CHANNELS AND HARBORS REPLACEMENT LOCK	156,000	8,600	0	0	0	156,000
NCE	HOLLAND HARBOR ENTRANCE CHANNEL	2,650	650	0	0	0	2,650
SAM	TENNESSEE-TOMBIGBEE WATERWAY, WILDLIFE MITIGATION, MS & AL	37,860	800	0	0	0	37,860
NAP	DEL RIV PHILA PA-TRENTON,NJ SEC 201,1976, TIOGA MARINE TERMI	1,810	265	0	0	0	1,810
NAN	NEW YORK HBR & ADJ CHANNELS, CLAREMONT TERMINAL, NJ	1,350	1,350	0	0	0	1,350
NCB	PORT BAY 1950 R&H ACT	3,330	1,000	0	0	0	3,330
NCB	CONNEAUT HBR 1966 R&H ACT 6FT CHANNEL AND BKW	1,920	725	0	0	0	1,920
NPP	YAQUINA SOUTH JETTY (JETTY RAISE)	1,175	300	0	0	0	1,175
SAJ	SAN JUAN HARBOR, PR	53,800	2,000	0	0	0	53,800
NED	GURTON'S POND, WARWICK, RI	150	150	0	0	0	150
SWT	RED RIVER WATERWAY,TX,AR,OK&LA (INDEX AR TO DENISON DAM TX)	225,000	5,000	0	0	0	225,000
NAO	HAMPTON ROADS DEBRIS REMOVAL, VA (NAVIGATION) (PED)	2,490	550	0	0	0	2,490
	TOTALS NO. OF PROJECTS	711,213 18	32,510	0	0	0	711,213
	GRAND TOTALS NO. OF PROJECTS	1,912,882 64	80,217	0	0	0	1,912,882

PRECONSTRUCTION ENGINEERING AND DESIGN NOT IN FY 89 BUDGET (AUTH PROJECTS)
PED NOT COMPLETED (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
BEACH EROSION							
SAJ	MONROE COUNTY, FL	1,624	318	125	0	0	1,499
NCC	INDIANA SHORELINE EROSION, IN	8,340	370	215	0	0	8,125
NAP	GREAT EGG HBR INLET & PECK BE, NJ	186,900	570	520	0	0	186,380
NCB	MAUMEE BAY STATE PARK, OH	4,520	575	450	0	0	4,070
	TOTALS NO. OF PROJECTS	201,384 4	1,833	1,310	0	0	200,074
FLOOD CONTROL							
SAM	FORT TOULOUSE, AL	12,440	530	275	0	0	12,165
SAM	MOUNDVILLE, AL	4,050	475	270	0	0	3,780
SWL	LITTLE RIVER, HORATIO, AR (STREAMBANK EROSION CONTROL PROG)	375	105	75	0	0	300
SPL	GOLETA AND VICINITY, CA	49,600	2,650	1,263	0	0	48,337
LMS	MEREDOSIA LAKE AND WILLOW CREEK D&LD, IL	10,000	1,400	576	0	0	9,424
LMS	MEREDOSIA, IL & MEREDOSIA, WILLOW CREEK AND COON RUN D&L DIS	12,100	1,500	948	0	0	11,152
ORL	RUSSELL & ALLISON LEVEE 1938 ACT LAWRENCE	16,600	1,025	52	0	0	16,548
MRK	FORT SCOTT LAKE,KS	66,750	1,300	758	0	0	65,992
LMK	RED RIVER WATERWAY SHREVEPORT, LA TO VICINITY INDEX, AR	217,000	2,200	1,728	0	0	215,272
NCE	SAGINAW RIVER,MI	50,700	24,461	24,390	0	0	26,310
NCS	SAUK LAKE, MN	324	250	95	0	0	229
NAN	RAHWAY RIVER BASIN, ROBINSON'S BRANCH, AT RAHWAY, NJ	4,210	1,050	850	0	0	3,360
ORL	HOLES CREEK AT WEST CARROLLTON AND MORAINE, OH	6,080	770	258	0	0	5,822

PRECONSTRUCTION ENGINEERING AND DESIGN NOT IN FY 89 BUDGET (AUTH PROJECTS)
PED NOT COMPLETED (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL							
ORH	KILLBUCK LPP, MUSKINGUM RIVER, OH	4,800	600	134	0	0	4,666
NPP	JOHNSON CREEK OR	5,680	478	128	0	0	5,552
NPP	PENINSULA DRAINAGE DISTRICT NO. 2, OR	3,600	505	35	0	0	3,565
NAB	LOCK HAVEN, PA	68,000	3,881	3,675	0	0	64,325
NAP	POTTSTOWN,PA -SEC 201, AUTH 1974	4,710	1,030	487	0	0	4,223
SWG	LOWER RIO GRANDE BASIN, TX	130,000	3,300	1,370	0	0	128,630
NPS	CHEHALIS RIVER AT SOUTH ABERDEEN AND COSMOPOLIS, WA	17,400	1,564	1,247	0	0	16,153
ORP	ROWLESBURG LAKE, WV (1965 ACT)	784,000	3,600	2,858	0	0	781,142
	TOTALS NO. OF PROJECTS	1,468,419 21	52,674	41,472	0	0	1,426,947
MULTIPLE PURPOSE							
MRO	EAGLE BAY & FT YATES HYW BRIDGE, ND 1970 ACT	40,600	800	617	0	0	39,983
	TOTALS NO. OF PROJECTS	40,600 1	800	617	0	0	39,983
NAVIGATION							
SAM	MONTGOMERY TO GADSDEN, AL (1945 ACT)	1,290,000	32,000	11,300	0	0	1,278,700
NED	NEW HAVEN HARBOR, CT	20,130	920	651	0	0	19,479
LMK	RED RIVER WATERWAY,SHREVEPORT, LA TO DAINGERFIELD,TX-LA,	624,000	12,800	70	0	0	623,930
NCE	CROSS VILLAGE HBR, MI.	2,985	730	364	0	0	2,621
NCE	MONROE HARBOR, MI	57,597	2,250	442	0	0	57,155
NCS	HARRIET ISLAND HARBOR, MN	292	90	9	0	0	283

PRECONSTRUCTION ENGINEERING AND DESIGN NOT IN FY 89 BUDGET (AUTH PROJECTS)
PED NOT COMPLETED (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	UNSCHEDULED
NAVIGATION							
LMS	ST. LOUIS HARBOR, MO & IL	11,400	2,600	943	0	0	10,457
NAP	CURSONS INLET & LUDHAM BEACH, NJ	88,200	531	314	0	0	87,886
NCB	ELK CREEK HARBOR,PA 1966 ACT	3,810	975	102	0	0	3,708
NPS	BLAIR & SITCUM WATERWAYS, WA	23,400	4,720	1,310	0	0	22,090
NCE	GREEN BAY HARBOR 1962 ACT BROWN COUNTY	3,637	690	350	0	0	3,287
	TOTALS NO. OF PROJECTS	2,125,451 11	58,306	15,855	0	0	2,109,596
	GRAND TOTALS NO. OF PROJECTS	3,835,854 37	113,613	59,254	0	0	3,776,600

MISSISSIPPI RIVER AND TRIBUTARIES
PRECONSTRUCTION ENGINEERING AND DESIGN NOT IN FY 89 BUDGET (AUTH PROJECTS)
PED NOT COMPLETED (THOUSANDS OF DOLLARS)

SELECTION-1: 34
SELECTION-2: A

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	UNSCHEDULED
NAVIGATION							
LMK	VICKSBURG HARBOR, MS	55,900	1,400	250	0	0	55,650
	TOTALS NO. OF PROJECTS	55,900 1	1,400	250	0	0	55,650
	GRAND TOTALS NO. OF PROJECTS	55,900 1	1,400	250	0	0	55,650

PRECONSTRUCTION ENGINEERING AND DESIGN NOT IN FY 89 BUDGET (AUTH PROJECTS)
PED FULLY FUNDED (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
BEACH EROSION							
SAJ	MANATEE COUNTY, FL	11,100	300	300	0	0	10,800
	TOTALS NO. OF PROJECTS	11,100 1	300	300	0	0	10,800
FLOOD CONTROL							
SPL	SANTA ANA RIVER MAINSTEM, CA	941,000	25,723	25,723	0	0	915,277
LMS	MERAMEC RIVER BASIN, MO (PL 97-128) (FC)	10,454	1,500	1,500	0	0	8,954
NAN	RAMAPO AND MAHWAH RIVERS AT MAHWAH, NJ & SUFFERN, NY	5,930	700	700	0	0	5,230
NAN	SAW MILL RIVER AT ELMSFORD AND GREENBURGH, NY	6,000	950	950	0	0	5,050
NCB	OTTAWA, OH	990	385	385	0	0	605
	TOTALS NO. OF PROJECTS	964,374 5	29,258	29,258	0	0	935,116
MULTIPLE PURPOSE							
SWL	BEAVER LAKE, AR, WATER QUALITY ENHANCEMENT	3,825	400	400	0	0	3,425
SAS	LAKE LANIER REREGULATION, METRO ATLANTA, GA	2,150	2,150	2,150	0	0	0
NPP	STRUBE LAKE & COUGAR ADDL UNIT, OR	93,600	1,790	1,790	0	0	91,810
	TOTALS NO. OF PROJECTS	99,575 3	4,340	4,340	0	0	95,235
NAVIGATION							
NPA	KAKE HARBOR, AK	13,200	846	846	0	0	12,354
SPN	NOYO RIVER AND HARBOR (CHANNEL EXTENSION), CA	1,980	580	580	0	0	1,400

PRECONSTRUCTION ENGINEERING AND DESIGN NOT IN FY 89 BUDGET (AUTH PROJECTS)
PED FULLY FUNDED (THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	FED COST OF PED	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
	NAVIGATION						
NAN	ARTHUR KILL CHANNEL-HOWLAND HOOK MARINE TERMINAL, NY & NJ	45,000	1,100	1,100	0	0	43,900
NAN	SHINNECOCK INLET, NY	18,230	1,000	1,000	0	0	17,230
SWT	BIG & LITTLE SALLISAW CREEK OK	6,100	335	335	0	0	5,765
NPP	CHETCO RIVER, OR	8,480	235	235	0	0	8,245
SWG	NECHES RIV & TRIBS SALTWATER BARRIER,TX 1976	26,527	1,504	1,504	0	0	25,023
	TOTALS NO. OF PROJECTS	119,517 7	5,600	5,600	0	0	113,917
	GRAND TOTALS NO. OF PROJECTS	1,194,566 16	39,498	39,498	0	0	1,155,068

CONSTRUCTION NEW STARTS IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL						
SPK	CACHE CREEK SETTLING BASIN, CA	15,600	640	3,250	11,290	420
SPL	SANTA ANA RIVER MAINSTEM, CA	941,000	16,738	15,000	885,897	23,365
NAN	RAMAPO AND MAHWAH RIVERS, MAHWAH, NJ AND SUFFERN, NY	5,930	696	300	4,934	0
NCS	SHEYENNE RIVER, WEST FARGO AND RIVERSIDE, ND	45,200	3,633	2,700	14,037	24,830
NAB	LOCK HAVEN, PA	58,500	2,782	1,000	54,718	0
	TOTALS NO. OF PROJECTS	1,066,230 5	24,489	22,250	970,876	48,615
	GRAND TOTALS NO. OF PROJECTS	1,066,230 5	24,489	22,250	970,876	48,615

MISSISSIPPI RIVER AND TRIBUTARIES
CONSTRUCTION NEW STARTS IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

SELECTION-1: 34
SELECTION-2: A

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL						
LMM	NONCONNAH CREEK, TN & MS	13,600	1,400	1,500	10,430	270
	TOTALS NO. OF PROJECTS	13,600 1	1,400	1,500	10,430	270
	GRAND TOTALS NO. OF PROJECTS	13,600 1	1,400	1,500	10,430	270

CONTINUING CONSTRUCTION IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
BEACH EROSION						
SPL	SURFSIDE-SUNSET-NEWPORT BEACH, CA	30,200	9,722	1,300	9,619	9,559
SAJ	DUVAL COUNTY, FL	16,400	12,957	3,443	0	0
SAJ	PINELLAS COUNTY, FL	20,000	6,998	4,000	9,002	0
NED	ROOSEVELT CAMPOBELLO INTERNATIONAL PARK, LUBEC, ME & CANADA	200	0	200	0	0
NED	REVERE BEACH, MA	7,605	858	3,510	1,287	1,950
NAP	CAPE MAY INLET TO LOWER TOWNSHIP, NJ	70,700	4,063	1,000	59,490	6,147
NAN	SANDY HOOK TO BARNEGAT INLET, NJ	199,000	7,035	1,200	190,765	0
NCB	PRESQUE ISLE PENINSULA, PA (NOURISHMENT)	16,044	14,814	1,230	0	0
NCB	PRESQUE ISLE PENNISULA, PA	13,700	670	4,000	8,030	1,000
NAO	TANGIER ISLAND SHORELINE PROTECTION, VA	2,840	264	2,576	0	0
	TOTALS NO. OF PROJECTS	376,689 10	57,381	22,459	278,193	18,656
FLOOD CONTROL						
SAM	THREEMILE CREEK, MOBILE, AL	13,970	4,842	4,500	4,628	0
SAM	VILLAGE CREEK, JEFFERSON COUNTY, AL	26,335	556	3,800	21,979	0
SPL	PHOENIX ARIZONA AND VICINITY, AZ (STAGE 2)	231,000	114,096	41,000	75,904	0
SWL	FOURCHE BAYOU BASIN, LITTLE ROCK, AR	14,000	2,763	2,500	8,737	0
SPK	CORTE MADERA CREEK, CA	14,400	11,664	1,800	936	0
SPK	DRY CREEK (WARM SPRINGS) LAKE, CA	349,000	312,720	750	0	35,530
SPK	FAIRFIELD VICINITY STREAMS, CA	11,000	7,849	2,400	751	0
SPK	LOWER SAN JOAQUIN RIVER, CA	22,576	17,074	1,500	4,002	0

CONTINUING CONSTRUCTION IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL						
SPK	MERCED COUNTY STREAMS, CA	65,200	5,500	4,000	1,600	54,100
SPK	PAJARO RIVER, CA	5,395	2,925	2,470	0	0
SPK	REDBANK AND FANCHER CREEK, CA	52,200	2,635	4,500	45,065	0
SPK	SACRAMENTO RIVER BANK PROTECTION PROJECT, CA	95,800	72,034	10,000	13,766	0
SPK	SACRAMENTO RIVER FLOOD CONTROL PROJECT, CA (DEF CORR)	74,800	72,515	2,285	0	0
SPL	SAN LUIS REY RIVER, CA	32,600	5,074	6,200	21,326	0
SPK	WALNUT CREEK, CA	63,400	56,247	6,300	853	0
SPK	WILDCAT AND SAN PABLO CREEKS, CA	21,500	10,616	1,800	9,084	0
MRO	CHATFIELD LAKE, CO	95,000	94,123	400	477	0
SWA	FOUNTAIN CREEK, PUEBLO, CO	6,270	3,100	2,700	470	0
MRO	WESTERLY CREEK, CO	7,607	776	5,100	1,731	0
NAP	DELAWARE COAST PROTECTION, DE	8,750	3,179	525	5,046	0
SAJ	CENTRAL AND SOUTHERN FLORIDA, FL	838,000	313,335	19,000	106,541	399,124
SAJ	DADE COUNTY, FL	48,800	36,843	1,900	10,057	0
SAJ	FOUR RIVER BASINS, FL	153,000	70,710	800	1,500	79,990
SAS	OATES CREEK, RICHMOND COUNTY, GA	9,875	609	2,000	7,266	0
POD	AGANA RIVER, GU	4,090	2,250	1,840	0	0
POD	KAHOMA STREAM, MAUI, HI	10,840	9,056	1,784	0	0
LMS	ALTON TO GALE ORGANIZED LEVEE DISTRICTS, IL & MO (DEF CORR)	92,345	89,470	1,000	1,875	0
LMS	EAST ST. LOUIS, IL	17,250	1,000	3,000	13,250	0

CONTINUING CONSTRUCTION IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL						
NCC	NORTH BRANCH CHICAGO RIVER, IL	16,600	2,495	4,000	6,155	3,950
NCR	SOUTH QUINCY LEVEE AND DRAINAGE DISTRICT, IL	7,550	2,700	3,600	1,250	0
ORL	EVANSVILLE, IN	49,500	32,790	4,000	12,710	0
NCR	DES MOINES RECREATION RIVER AND GREENBELT, IA	4,623	964	750	2,909	0
MRK	MISSOURI RIVER LEVEE SYSTEM, IA, NE, KS, & MO	138,881	89,919	350	360	48,252
SWT	GREAT BEND, KS	31,600	3,422	3,500	24,678	0
SWT	HALSTEAD, KS	5,800	642	1,800	3,358	0
ORN	BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA, KY & TN	132,072	103,522	4,500	0	24,050
ORH	PAINTSVILLE LAKE, KY	63,784	59,097	500	1,570	2,617
ORL	SOUTHWESTERN JEFFERSON COUNTY, KY	57,700	54,617	3,083	0	0
ORL	TAYLORSVILLE LAKE, KY	92,420	82,772	540	850	8,258
ORH	YATESVILLE LAKE, KY	104,000	68,296	11,800	23,904	0
LMN	GRAND ISLE AND VICINITY, LA	14,661	11,044	1,500	2,117	0
LMN	LAKE PONTCHARTRAIN AND VICINITY, LA (HURRICANE PROTECTION)	521,000	209,041	40,400	269,692	1,867
LMN	LAROSE TO GOLDEN MEADOW, LA (HURRICANE PROTECTION)	69,400	51,301	2,970	15,129	0
LMN	NEW ORLEANS TO VENICE, LA (HURRICANE PROTECTION)	225,000	62,768	12,900	149,332	0
LMK	OUACHITA RIVER LEVEES, INCLUDING BAWCOMVILLE, LA	8,300	2,786	900	0	4,614

CONTINUING CONSTRUCTION IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL						
LMK	PEARL RIVER, SLIDELL, ST. TAMMANY PARISH, LA	19,200	1,362	400	17,438	0
NED	TOWN BROOK, QUINCY AND BRAINTREE, MA	21,600	1,470	7,950	12,180	0
NCS	BASSETT CREEK, MN	24,900	10,892	1,500	12,508	0
NCS	CHASKA, MN	20,500	2,093	1,000	17,407	0
NCS	MANKATO AND NORTH MANKATO, MN	95,700	93,481	2,219	0	0
NCS	SOUTH FORK ZUMBRO RIVER AT ROCHESTER, MN	61,200	6,497	7,100	47,603	0
SAM	SOWASHEE CREEK, MERIDIAN, MS	13,743	2,546	5,400	5,797	0
SAM	TOMBIGBEE RIVER AND TRIBUTARIES, MS & AL	48,000	24,783	2,595	0	20,622
MRK	BLUE RIVER CHANNEL, KANSAS CITY, MO	174,000	26,618	9,116	138,266	0
NCR	HANNIBAL, MO	4,690	1,029	1,000	2,661	0
MRK	LITTLE BLUE RIVER LAKES, MO	140,500	137,483	3,017	0	0
MRO	MISSOURI NATIONAL RECREATIONAL RIVER, NE & SD	21,000	857	75	350	19,718
MRO	PAPILLION CREEK AND TRIBUTARIES LAKES, NE	57,300	48,763	3,547	4,990	0
NAN	LIBERTY STATE PARK LEVEE AND SEAWALL, NJ	18,200	13,422	4,778	0	0
SWA	ALAMOGORDO, NM	22,800	1,859	7,400	13,541	0
SWA	PUERCO RIVER AT GALLUP, NM	5,250	713	3,100	1,437	0
SWA	RIO GRANDE FLOODWAY, TRUTH OR CONSEQUENCES UNIT, NM	11,700	1,663	3,800	6,237	0
NAN	ARDSLEY, NY	4,830	2,150	2,680	0	0
NCB	ELLICOTT CREEK, NY	10,254	9,054	1,200	0	0
SAW	B. EVERETT JORDAN DAM AND LAKE, NC	138,000	133,532	4,468	0	0

CONTINUING CONSTRUCTION IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL						
SAW	CAROLINA BEACH AND VICINITY, NC	16,700	8,699	300	1,510	6,191
SAW	FALLS LAKE, NC	165,000	147,460	8,000	9,540	0
NCB	SOURIS RIVER BASIN, ND	80,100	25,072	17,600	37,428	0
ORL	MILL CREEK, OH	159,000	69,035	20,000	69,965	0
ORH	NEWARK, OH	10,100	8,018	2,082	0	0
NCB	RENO BEACH HOWARD FARMS, OH	5,540	1,697	1,610	2,233	0
SWT	ARCADIA LAKE, OK	89,700	81,740	2,000	5,960	0
SWT	MINGO CREEK, OK	110,000	3,469	6,200	100,331	0
SWT	PARKER LAKE, OK	47,100	6,110	2,000	38,990	0
NPP	ELK CREEK LAKE, OR	116,300	94,693	1,900	0	19,707
NPP	LOWER COLUMBIA RIVER BASIN BANK PROTECTION, OR & WA	24,700	20,941	200	450	3,109
NPP	WILLAMETTE RIVER BASIN BANK PROTECTION, OR	29,200	24,848	160	640	3,552
NAB	FRANCIS E. WALTER DAM, PA (MODIFICATION)	20,600	9,429	4,200	6,971	0
NAB	TAMAQUA, PA	9,225	1,940	1,640	3,425	2,220
ORP	TURTLE CREEK, PA	17,151	15,644	200	1,307	0
SAJ	PORTUGUES AND BUCANA RIVERS, PR	302,000	192,702	26,000	24,071	59,227
SWF	MUGGY CREEK, AUSTIN, TX	15,800	4,452	8,000	3,348	0
SWG	CLEAR CREEK, TX	50,500	5,400	4,300	40,800	0
SWF	COOPER LAKE AND CHANNELS, TX	133,000	48,976	21,800	42,274	19,950
SWA	EL PASO, TX	108,700	59,965	4,400	44,335	0

CONTINUING CONSTRUCTION IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL						
SWF	JOE POOL LAKE, TX	184,000	178,989	4,500	511	0
SWT	LAKE WICHITA, HOLLIDAY CREEK AT WICHITA FALLS, TX	29,600	2,205	7,500	19,895	0
SWF	RAY ROBERTS LAKE, TX	294,000	254,213	20,000	19,787	0
SWF.	SAN ANTONIO CHANNEL IMPROVEMENT, TX	116,000	66,574	25,000	24,426	0
SWG	TAYLORS BAYOU, TX	41,000	22,167	4,400	14,433	0
SPK	LITTLE DELL LAKE, UT	33,300	8,395	7,800	17,105	0
NAO	RICHMOND, VA	67,700	5,266	11,100	51,334	0
NAO	VIRGINIA BEACH STREAMS CANAL NO. TWO, VA	4,800	4,043	757	0	0
NPP	MT. ST. HELENS SEDIMENT CONTROL, WA	152,000	72,618	21,500	0	57,882
ORH	LEVISA & TUG FORKS & UPPER CUMBERLAND RIVER, WV, KY, & VA	468,000	160,150	42,400	110,285	155,165
ORP	STONEWALL JACKSON LAKE, WV	212,000	189,639	13,300	9,061	0
NCS	STATE ROAD AND EBNER COULEES, WI	26,600	2,112	6,400	18,088	0
	TOTALS NO. OF PROJECTS	7,980,677 97	4,478,665	602,541	1,869,776	1,029,695
MULTIPLE PURPOSE						
NPA	SNETTISHAM, AK	135,000	127,155	5,845	0	0
SAS	RICHARD B. RUSSELL DAM AND LAKE, GA & SC	554,000	458,500	32,000	63,500	0
MRK	HARRY S. TRUMAN DAM AND RESERVOIR, MO	550,000	533,490	6,445	0	10,065
NPP	BONNEVILLE SECOND POWERHOUSE, OR & WA	672,000	654,669	2,500	3,800	11,031
NPS	CHIEF JOSEPH ADDITIONAL UNITS, WA	413,000	373,247	6,600	33,153	0
NPW	LOWER SNAKE RVR FISH & WILDLIFE COMPENSATION, WA, OR, & ID	185,000	140,337	12,200	15,022	17,441
	TOTALS NO. OF PROJECTS	2,507,000 6	2,287,398	65,590	115,475	38,537

CONTINUING CONSTRUCTION IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
NAVIGATION						
SAM	BLACK WARRIOR AND TOMBIGBEE RIVERS, VICINITY OF JACKSON, AL	1,905	50	50	1,805	0
SAM	MOBILE HARBOR, AL	258,550	16,156	9,685	2,809	229,900
SAM	WILLIAM BACON OLIVER LOCK AND DAM, AL	121,000	40,162	31,000	49,838	0
NPA	ST. PAUL HARBOR, AK	16,648	3,143	7,000	6,505	0
SWL	MCCLELLAN-KERR ARK. RVR NAV. SYSTEM LOCKS AND DAMS, AR & OK	561,000	547,453	8,500	5,047	0
LMK	OUACHITA AND BLACK RIVERS, AR & LA	258,000	227,046	2,000	21,043	7,911
SPN	OAKLAND HARBOR, CA	21,600	7,164	10,000	4,436	0
SPN	RICHMOND HARBOR, CA	8,000	1,929	430	5,641	0
SPK	SACRAMENTO RIVER DEEPWATER SHIP CHANNEL, CA	41,200	2,753	5,300	33,147	0
SPK	SAN FRANCISCO BAY TO STOCKTON, CA	132,000	53,293	1,700	6,062	70,945
SAJ	MANATEE HARBOR, FL	9,430	500	5,000	3,930	0
SAS	SAVANNAH HARBOR, GA	8,800	3,040	5,760	0	0
LMS	LOCK AND DAM 26, MISSISSIPPI RIVER, ALTON, IL & MO	752,000	564,638	50,000	133,912	3,450
LMS	LOCK AND DAM 26, SECOND LOCK, MISS. RIVER, ALTON, IL & MO	213,000	12,136	13,000	187,864	0
NCR	UPPER MISS. RVR SYSTEM ENV. MGT PROG., IL, IA, MO, MN, & WI	191,000	7,177	7,000	171,823	5,000
LMN	MISSISSIPPI RIVER - GULF OUTLET, LA	509,000	84,717	500	8,883	409,900
LMN	MISSISSIPPI RIVER SHIP CHANNEL, GULF TO BATON ROUGE, LA	143,000	12,127	3,800	11,396	115,677
LMK	RED RIVER WATERWAY, MISSISSIPPI RIVER TO SHREVEPORT, LA	1,645,000	883,053	118,000	201,656	440,291

CONTINUING CONSTRUCTION IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
NAVIGATION						
NED	JONESPORT HARBOR, ME	8,100	6,300	1,800	0	0
NAB	BALTIMORE HARBOR AND CHANNELS, MD & VA	148,000	52,767	27,600	27,133	40,500
LMS	MISS. RIVER BTWN OHIO AND MO RIVERS (REG. WORKS), MO & IL	187,000	118,445	4,400	64,155	0
NED	PORTSMOUTH HARBOR AND PISCATAQUA RIVER, NH & ME	11,250	3,000	6,900	1,350	0
NAP	BARNEGAT INLET, NJ	29,480	10,760	7,800	10,920	0
NAN	HEMPSTEAD HARBOR, NY	2,130	190	400	1,540	0
NAN	KILL VAN KULL AND NEWARK BAY CHANNEL, NY & NJ	193,000	57,019	54,300	0	81,681
NAN	MORICHES INLET, NY	9,100	7,875	1,225	0	0
NAN	NEW YORK HARBOR COLLECTION AND REMOVAL OF DRIFT, NY & NJ	51,900	29,091	1,409	0	21,400
SAW	AIWW-REPLACEMENT OF FEDERAL HIGHWAY BRIDGES, NC	68,700	23,001	550	2,049	43,100
NPP	BONNEVILLE NAVIGATION LOCK, OR & WA	212,000	67,904	42,000	102,096	0
ORP	GRAYS LANDING, LOCK AND DAM 7, MONONGAHELA RIVER, PA	165,000	9,980	14,200	140,820	0
ORP	POINT MARION, LOCK AND DAM 8, MONONGAHELA RIVER, PA & WV	82,900	2,052	2,800	300	77,748
SAC	CHARLESTON HARBOR, SC	75,350	2,535	7,000	65,815	0
SWG	CORPUS CHRISTI SHIP CHANNEL, TX	57,700	48,167	4,000	2,556	2,977
SWG	FREEPORT HARBOR, TX	57,900	12,698	11,300	33,902	0
SWG	MOUTH OF COLORADO RIVER, TX	32,600	15,865	5,800	10,935	0
NAO	LYNNHAVEN INLET AND CONNECTING CHANNELS, VA	1,934	334	1,600	0	0

CONTINUING CONSTRUCTION IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE	
					SCHEDULED	UNSCHEDULED
NAVIGATION						
NAD	NORFOLK HARBOR AND CHANNELS, VA	117,000	12,987	2,700	2,939	98,374
ORH	GALLIPOLIS LOCKS AND DAM, WV & OH	336,000	64,625	60,000	206,375	0
ORH	WINFIELD LOCK AND DAM, WV	153,000	3,190	6,500	8,200	135,110
	TOTALS	6,889,177	3,025,322	543,009	1,536,882	1,783,964
	NO. OF PROJECTS	39				
	GRAND TOTALS	17,753,543	9,848,766	1,233,599	3,800,326	2,870,852
	NO. OF PROJECTS	152				

MISSISSIPPI RIVER AND TRIBUTARIES
CONTINUING CONSTRUCTION IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL						
LMM	CACHE RIVER BASIN, AR	168,000	9,323	920	0	157,757
LMV	CHANNEL IMPROVEMENT, AR, IL, LA, MS, MO & TN	3,075,000	1,666,353	94,900	1,313,747	0
LMM	EIGHT MILE CREEK, AR	9,950	1,285	546	4,081	4,038
LMM	L'ANGUILLE RIVER, AR	14,800	3,312	800	10,688	0
LMV	MISSISSIPPI RIVER LEVEES, AR, IL, KY, LA, MS, MO, & TN	1,240,000	609,921	22,700	607,379	0
LMM	ST FRANCIS BASIN, AR & MO	376,000	266,354	9,900	99,746	0
LMK	TENSAS BASIN, AR & LA	452,000	244,960	6,600	137,580	62,860
LMN	ATCHAFALAYA BASIN, FLOODWAY SYSTEM, LA	139,000	3,561	11,700	81,284	42,455
LMN	ATCHAFALAYA BASIN, LA	1,460,000	591,723	31,000	837,277	0
LMN	MISSISSIPPI DELTA REGION, LA	57,900	6,614	7,450	8,544	35,292
LMK	YAZOO BASIN, MS	1,340,000	499,857	32,600	709,183	98,360
LMM	WEST TENNESSEE TRIBUTARIES, TN	108,000	40,519	5,100	62,381	0
	TOTALS NO. OF PROJECTS	8,440,650 12	3,943,782	224,216	3,871,890	400,762
NAVIGATION						
LMM	HELENA HARBOR, PHILLIPS COUNTY, AR	41,400	1,027	5,300	12,359	22,714
	TOTALS NO. OF PROJECTS	41,400 1	1,027	5,300	12,359	22,714
	GRAND TOTALS NO. OF PROJECTS	8,482,050 13	3,944,809	229,516	3,884,249	423,476

DAM SAFETY ASSURANCE IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL						
NCS	LAKE ASHTABULA & BALDHILL DAM, SHEYENNE RVR, ND (DAM SAFETY)	36,100	1,080	1,000	34,020	0
ORH	BOLIVAR DAM, MUSKINGUM RIVER LAKES, OH (DAM SAFETY)	7,400	4,200	3,200	0	0
SWG	BUFFALO BAYOU & THIBS-ADDICKS & BARKER DAMS, TX (DAM SAFETY)	10,900	9,471	1,429	0	0
NPS	MUD MOUNTAIN DAM, WA (DAM SAFETY)	43,800	4,039	1,200	38,561	0
	TOTALS	98,200	18,790	6,829	72,581	0
	NO. OF PROJECTS	4				
MULTIPLE PURPOSE						
SAC	COOPER RIVER SEISMIC MODIFICATION, SC	28,000	23,998	4,002	0	0
	TOTALS	28,000	23,998	4,002	0	0
	NO. OF PROJECTS	1				
	GRAND TOTALS	126,200	42,788	10,831	72,581	0
	NO. OF PROJECTS	5				

MISSISSIPPI RIVER AND TRIBUTARIES
DAM SAFETY ASSURANCE IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

SELECTION-1: 34
SELECTION-2: A

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL						
LMK	SARDIS DAM, MS (DAM SAFETY ASSURANCE)	7,400	6,040	600	760	0
	TOTALS	7,400	6,040	600	760	0
	NO. OF PROJECTS	1				
	GRAND TOTALS	7,400	6,040	600	760	0
	NO. OF PROJECTS	1				

CONSTRUCTION PROJECTS NOT IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	UNSCHEDULED
BEACH EROSION						
SPL	IMPERIAL BEACH, CA	3,340	3,340	0	0	0
SAJ	BREVARD COUNTY,FL 1968 ACT	8,650	2,346	0	0	6,304
SAJ	BROWARD COUNTY, FL (REIMB)	25,700	11,833	0	0	13,867
SAJ	INDIAN RIVER COUNTY, FL	27,300	55	0	0	27,245
SAJ	LEE COUNTY, FL	11,500	0	0	0	11,500
SAJ	PALM BEACH COUNTY, FL (REIMBURSEMENT)	24,500	4,164	0	0	20,336
NED	LYNN-NAHANT BEACH, ME (1954 ACT, REIMB)	1,400	820	0	0	580
NED	PLYMOUTHTOWN BEACH, MA (1960 ACT, REIMB)	265	6	0	0	259
NCE	SKY HARBOR A/P EROSION CONTROL, DULUTH, MN	250	250	0	0	0
NAP	GREAT EGG HARBOR INLET & PECK BEACH, NJ	186,900	0	0	0	186,900
NAN	EAST ROCKAWAY INLET - ROCKAWAY INLET AND JAMAICA BAY, NY	25,400	25,400	0	0	0
NCB	MAUMEE BAY STATE PARK, OH	4,400	580	0	0	3,820
NED	CLIFF WALK NEWPORT 1965 ACT	405	405	0	0	0
NAO	VIRGINIA BEACH, VA (REIMB)	17,500	5,000	0	0	12,500
	TOTALS	337,510	54,199	0	0	283,311
	NO. OF PROJECTS	14				
FLOOD CONTROL						
NPA	BETHEL BANK STABILIZATION, AK	10,725	597	0	0	10,128
NPA	CHENA RIVER LAKES, AK	210,000	209,386	0	0	614
SPL	GILA RIV-CAMELSBACK DAMSITE TO SALT RIVER,AZ	2,060	134	0	0	1,926

CONSTRUCTION PROJECTS NOT IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
	BEACH EROSION					
SPL	IMPERIAL BEACH, CA	3,340	3,340	0	0	0
SAJ	BREVARD COUNTY,FL 1968 ACT	8,650	2,346	0	0	6,304
SAJ	BROWARD COUNTY, FL (REIMB)	25,700	11,833	0	0	13,867
SAJ	INDIAN RIVER COUNTY, FL	27,300	55	0	0	27,245
SAJ	LEE COUNTY, FL	11,500	0	0	0	11,500
SAJ	PALM BEACH COUNTY, FL (REIMBURSEMENT)	24,500	4,164	0	0	20,336
NED	LYNN-NAHANT BEACH, ME (1954 ACT, REIMB)	1,400	820	0	0	580
NED	PLYMOUTHTOWN BEACH, MA (1960 ACT, REIMB)	265	6	0	0	259
NCE	SKY HARBOR A/P EROSION CONTROL, DULUTH, MN	250	250	0	0	0
NAP	GREAT EGG HARBOR INLET & PECK BEACH, NJ	186,900	0	0	0	186,900
NAN	EAST ROCKAWAY INLET - ROCKAWAY INLET AND JAMAICA BAY, NY	25,400	25,400	0	0	0
NCB	MAUMEE BAY STATE PARK, OH	4,400	580	0	0	3,820
NED	CLIFF WALK NEWPORT 1965 ACT	405	405	0	0	0
NAO	VIRGINIA BEACH, VA (REIMB)	17,500	5,000	0	0	12,500
	TOTALS NO. OF PROJECTS	337,510 14	54,199	0	0	283,311
	FLOOD CONTROL					
NPA	BETHEL BANK STABILIZATION, AK	10,725	597	0	0	10,128
NPA	CHENA RIVER LAKES, AK	210,000	209,386	0	0	614
SPL	GILA RIV-CAMELSBACK DAMSITE TO SALT RIVER,AZ	2,060	134	0	0	1,926

CONSTRUCTION PROJECTS NOT IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	UNSCHEDULED
FLOOD CONTROL						
SPL	SANTA ROSA WASH (TAT MOMOLIKOT DAM), AZ	17,219	17,219	0	0	0
SPK	SACRAMENTO RIVER AND MAJOR AND MINOR TRIBUTARIES, CA	11,900	11,900	0	0	0
SPL	SANTA PAULA CREEK CHANNEL, CA	37,000	4,791	0	0	32,209
SPL	SWEETWATER RIVER, CA	25,200	25,200	0	0	0
SPL	WHITEWATER RIVER BASIN, FLOODWARNING SYSTEM, CA	300	300	0	0	0
NAB	ANACOSTIA RIVER,MD,DC (REMEDIAL)	250	0	0	0	250
SAJ	DADE COUNTY, NORTH OF HAULOVER BEACH PARK, FL	13,500	8,450	0	0	5,050
ORL	GALLATIN COUNTY STREAMBANK EROSION, AREA 1, OHIO RIVER, IL	1,000	87	0	0	913
LMS	KASKASKIA ISLAND D&LD, ILLINOIS	17,088	3,951	0	0	13,137
NCC	L MICH EDGEWATER AREA, CHICAGO, IL	1,822	210	0	0	1,612
LMS	MAUVAISE TERRE DRAINAGE AND LEVEE DISTRICT, IL	1,499	949	0	0	550
NCR	MUCK LEVEE,IL	12	0	0	0	12
NCR	RED ROCK DAM AND LAKE, IOWA (LAND AQUISITION)	28,400	0	0	0	28,400
NCR	SAYLORVILLE LAKE,IA 1958 ACT	130,100	115,763	0	0	14,337
NCR	WATERLOO, IA, BRIDGES	1,150	0	0	0	1,150
ORL	CAMPGROUND LAKE, KY (1974 ACT PH I)	1,400	250	0	0	1,150
ORL	CAVE RUN LAKE,KY 1936,38 ACTS	79,613	74,262	0	0	5,351
ORL	SALYERSVILLE, KY	2,400	221	0	0	2,179

CONSTRUCTION PROJECTS NOT IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL						
ORL	TAYLORSVILLE LAKE, KY (FLOYDS FORK BRIDGE REPLACEMENT)	50	0	0	0	50
LMK	BAYOU BODCAU & TRIBS,LA 1965 ACT	26,600	5,456	0	0	21,144
NED	ST JOHN RIVER BASIN, ME (SEC 1108, 86 ACT)	3,430	0	0	0	3,430
NCE	KALAMAZOO,MI 1958 ACT	4,320	422	0	0	3,898
NCS	EAST GRAND FORKS, MN	17,500	1,733	0	0	15,767
NCS	REDWOOD RIVER AT MARSHALL, MN	5,260	650	0	0	4,610
NCS	ROSEAU R, MN (1965 ACT)	23,400	2,128	0	0	21,272
NCS	TWIN VALLEY LAKE, WILD RICE RIVER, MN	22,200	2,119	0	0	20,081
SAM	TALLAHALA CREEK LAKE,MS 1968 ACT	62,540	3,946	0	0	58,594
MRK	LONG BRANCH LAKE, MO	20,391	18,286	0	0	2,105
LMS	MERAMEC RIVER BASIN~~,~~ MISSOURI	10,420	1,500	0	0	8,920
MRK	TRIMBLE WILDLIFE AREA, SMITHVILLE LAKE, MO	1,570	0	0	0	1,570
NAN	RARITAN & SANDY HOOK BAYS, NJ 1962 ACT REIMB	9,050	7,793	0	0	1,257
SWA	ACEQUIAS IRRIGATION SYSTEM, NM	40,000	1,778	0	0	38,222
SWA	COCHITI WETLANDS	750	50	0	0	700
SWA	MIDDLE RIO GRANDE PROTECTION, BERNALILLO TO BELEN, NM	36,400	1,177	0	0	35,223
NCB	DANSVILLE, NY	910	490	0	0	420
NAB	ENDICOTT JOHNSON CITY & VESTAL, NY (MOD)	530	0	0	0	530
NAN	FIRE ISL INL - MONTAUK POINT,NY 1960/74 ACTS	222,000	10,428	0	0	211,572

CONSTRUCTION PROJECTS NOT IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL						
SAW	RANDLEMAN LAKE, NC	29,200	0	0	0	29,200
SAW	WRIGHTSVILLE BEACH HURR PROT,NC 1962 ACT	14,600	1,813	0	0	12,787
ORL	CAESAR CREEK LAKE,OH, 1938,58, 61 ACTS	64,781	62,894	0	0	1,887
NCB	CUYAHOGA RIVER BASIN,OH 1970 ACT	21,000	0	0	0	21,000
ORH	MASSILLON BRIDGES, OH (SEC 803, 86 ACT)	1,100	750	0	0	350
NCB	OTTAWA, OH	1,040	385	0	0	655
ORL	WILLIAM H HARSHA LAKE 1938,1958&1961ACTS	54,941	52,023	0	0	2,918
SWT	COPAN LAKE,OK,KS 1962 ACT	89,277	89,277	0	0	0
SWT	LUKFATA LAKE, OK 1958 ACT	39,900	1,425	0	0	38,475
SWT	MINGO CREEK, OK	110,000	0	0	0	110,000
SWT	RED RIVER BASIN CHLORIDE CONTOL, TX & OK	142,000	11,460	0	0	130,540
SWT	SARDIS LAKE OKLAHOMA	67,144	61,328	0	0	5,816
SWT	SKIATOOK LAKE OK	120,325	105,564	0	0	14,761
ORP	CHARTIERS CREEK,PA 1965 ACT	32,750	26,586	0	0	6,164
NAB	COWANESQUE LAKE, PA (MODIFICATION)	2,520	2,520	0	0	0
NAB	CURWENSVILLE LAKE, PA (WATER LINE)	230	0	0	0	230
NAB	MARSH CREEK BRIDGE, F.J. SAYERS DAM, PA	25	0	0	0	25
NAB	SUSQUEHANNA RIVER SUNBURY, PA (CLOSURE STRUCTURE)	56	0	0	0	56
NAB	TIOGA-HAMMOND LAKES,PA	193,185	186,235	0	0	6,950
SWT	ARK-RED RIV BSNS CHLOR CONT,TX-AREA VIII	50,833	47,233	0	0	3,600
SWG	BUFFALO BAYOU & TRIBS,TX 1938, 65 ACTS	127,000	57,206	0	0	69,794

CONSTRUCTION PROJECTS NOT IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
	FLOOD CONTROL					
LMK	RED RIVER BELOW DENISON DAM	59,650	59,607	0	0	43
SWG	VINCE AND LITTLE VINCE BAYOUS, TX	19,313	19,313	0	0	0
ORH	HAYSI LAKE, VA.	20,900	3	0	0	20,897
ORH	BEECH FORK LAKE, W.VA.	42,013	42,013	0	0	0
ORH	KANAWHA RIVER, CHARLESTON, WV (STRBK EROSION 86 ACT)	330	25	0	0	305
ORH	KANAWHA RIVER, ST ALBANS, WV (STRBN EROSION 86 ACT)	240	25	0	0	215
ORH	R D BAILEY LAKE, WV	261,237	261,237	0	0	0
NCS	LAFARGE LAKE & CHANNEL IMPRV., WI 1962 ACT	85,300	18,642	0	0	66,658
	TOTALS NO. OF PROJECTS	2,750,849 69	1,639,190	0	0	1,111,659
	MULTIPLE PURPOSE					
SPK	NEW MELONES LAKE, CA	391,000	359,547	0	0	31,453
LMS	CLARENCE CANNON DAM & MARK TWAIN LAKE, MO	330,000	312,692	0	0	17,308
SWT	EUFAULA LAKE, OKLAHOMA (BRIDGE REPLACEMENT)	1,900	1,520	0	0	380
SWT	FORT GIBSON, OK (POWER UNITS 5 & 6)	0 1/	0	0	0	0
NPP	BONNEVILLE PWR UNITS OR & WA	23,200	0	0	0	23,200
SWF	TOWN BLUFF HYDROPOWER, TX	0 1/	0	0	0	0
	TOTALS NO. OF PROJECTS	746,100 6	673,759	0	0	72,341
	NAVIGATION					
SAM	TENNESSEE - TOMBIGBEE WATERWAY, AL, MS	1,780,000	1,743,326	0	0	36,674

1/ Financed by local interests.

CONSTRUCTION PROJECTS NOT IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE	
					SCHEDULED	UNSCHEDULED
NAVIGATION						
SPL	MORRO BAY HARBOR OFFICE, CA	375	0	0	0	375
SPN	NOYO RIVER & HARBOR (CHANNEL EXTENSION)	1,980	580	0	0	1,400
SPN	NOYO RIVER AND HARBOR (BREAKWATER), CA	6,700	1,223	0	0	5,477
SPL	PORT SAN LUIS, SAN LUIS OBISPO HARBOR, CA	12,100	890	0	0	11,210
SPL	SAN DIEGO RIVER & MISSION BAY,CA	16,200	11,974	0	0	4,226
SAJ	CANAVERAL HARBOR, FL	16,900	12,262	0	0	4,638
SAJ	CROSS FLORIDA BARGE CANAL,FL 1962 ACT	32,000	8,846	0	0	23,154
SAJ	JACKSONVILLE HARBOR, MILL COVE, FL	4,160	3,950	0	0	210
SAJ	KISSIMMEE RIVER, FL	10,000	23	0	0	9,977
SAJ	TAMPA HARBOR BRANCH CHANNELS, FL	38,400	935	0	0	37,465
NCC	CALUMET HARBOR & RIVER,IL 1962, 65 ACTS	30,100	7,130	0	0	22,970
NCR	SAVANNA SBH, IL	304	85	0	0	219
ORL	SMITHLAND LOCKS AND DAM, IL, IN & KY	274,100	274,055	0	0	45
ORL	NEWBURGH LOCKS & DAM,IN,KY 1909 ACT	105,266	104,498	0	0	768
LMK	RED R EMER BANK PROTECTION - 1968, 1974, 1976 ACTS	85,400	73,788	0	0	11,612
NED	FALL RIVER HARBOR	2,967	2,967	0	0	0
NCE	CEDAR RIVER HARBOR MICH. 1965 ACT	1,188	265	0	0	923
NCE	GREAT LAKES CONNECT.CHANLS,MI 1946, 54 ACTS	144,000	129,697	0	0	14,303
NCE	PORT AUSTIN HARBOR	2,942	202	0	0	2,740
NCE	BEAVER BAY HBR MN 1945 ACT	1,790	0	0	0	1,790

CONSTRUCTION PROJECTS NOT IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
NAVIGATION						
NCE	KNIFE RIVER HBR MN	1,170	0	0	0	1,170
NCE	LUTSEN HARBOR,MN 1945 ACT	4,680	357	0	0	4,323
NCB	PORT ONTARIO, NY	2,420	2,420	0	0	0
SAW	AIWW MASONBORO INLET,NC 1950 ACT	9,630	8,100	0	0	1,530
SAW	MANTEO (SHALLOWBAG) BAY, NC	80,000	0	0	0	80,000
NCB	CLEVELAND HARBOR, OH	5,590	493	0	0	5,097
NCB	GENEVA-ON-THE-LAKE, OH	4,068	4,068	0	0	0
SWT	BIG AND LITTLE SALLISAW CREEKS, SALLISAW, OKLAHOMA	6,100	335	0	0	5,765
NPP	CHETCO RIVER, OR	9,040	0	0	0	9,040
SAJ	PONCE HARBOR, PR	7,320	6,482	0	0	838
NED	SEEKONK RIVER, PROVIDENCE,RI	250	0	0	0	250
SWG	GREENS BAYOU BRIDGE, TX	450	0	0	0	450
SWG	WALLISVILLE LAKE, TX	69,300	25,822	0	0	43,478
NPS	GRAYS HARBOR, WA (1986 WRDA)	59,720	0	0	0	59,720
NCE	KENOSHA HARBOR,WI 1962 ACT	548	300	0	0	248
NCE	SAXON HARBOR, WI	47	0	0	0	47
	TOTALS NO. OF PROJECTS	2,827,205 37	2,425,073	0	0	402,132
	GRAND TOTALS NO. OF PROJECTS	6,661,664 126	4,792,221	0	0	1,869,443

MISSISSIPPI RIVER AND TRIBUTARIES
CONSTRUCTION PROJECTS NOT IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
	FLOOD CONTROL					
LMK	LOWER ARKANSAS RIVER, AR SOUTH BANK	19,700	15,676	0	0	4,024
LMM	WEST KENTUCKY TRIBUTARIES, KY	22,800	0	0	0	22,800
LMK	LWR RED RIV-SOUTH BANK LEVEES,LA 1928,41,65	25,900	18,495	0	0	7,405
LMM	MUD LAKE PUMPING STATION	4,950	457	0	0	4,493
LMM	REELFOOT LAKE-LAKE NO 9,TN,KY,SEC 201, 1970	10,400	8,365	0	0	2,035
	TOTALS NO. OF PROJECTS	83,750 5	42,993	0	0	40,757
	GRAND TOTALS NO. OF PROJECTS	83,750 5	42,993	0	0	40,757

MAJOR REHABILITATION NOT IN FY 89 BUDGET (CG FUNDED)
(THOUSANDS OF DOLLARS)

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL						
ORH	MUSKINGUM RIVER LAKES, OH (REHAB)	22,048	22,048	0	0	0
	TOTALS NO. OF PROJECTS	22,048 1	22,048	0	0	0
	GRAND TOTALS NO. OF PROJECTS	22,048 1	22,048	0	0	0

DAM SAFETY ASSURANCE NOT IN FY 89 BUDGET
(THOUSANDS OF DOLLARS)

SELECTION-1: 34
SELECTION-2: A

DIST	NAME	TOT EST FED COST	ALLOC TO DATE	FY 89 BUDGET	BALANCE TO COMPLETE SCHEDULED	BALANCE TO COMPLETE UNSCHEDULED
FLOOD CONTROL						
ORH	MOHAWK DAM, MUSKINGUM RIVER LAKES, OH (DAM SAFETY)	8,500	7,465	0	0	1,035
	TOTALS NO. OF PROJECTS	8,500 1	7,465	0	0	1,035
	GRAND TOTALS NO. OF PROJECTS	8,500 1	7,465	0	0	1,035

Senator JOHNSTON. Provide for the record a complete list by project of all new contract awards scheduled for 1989, including the scheduled award date, what the funds will be used for, and the amount budgeted for 1989.

Mr. PAGE. I will provide the requested table for the record.

FY 1989 NEW CONTRACT AWARDS

89S-149 26 MAR 88

DIV	PROJECT	DESCRIPTION	AWARD DATE YYYYMMDD	TOTAL CONTRACT COST $000	FY 89 ESTIMATED EXPEND $000
LMVD	EAST ST. LOUIS IL	CHANNEL REHAB WORK	19890600	13,800	1,870
LMVD	GRAND ISLE AND VICINITY, LA	DUNE REPAIR & STRUC REINFORCE	19890500	5,334	2,200
LMVD	LAROSE TO GOLDEN MEADOW, LA	B-NOR B-SO C-SO LEV 2ND LIFT	19890200	3,140	600
LMVD	LAROSE TO GOLDEN MEADOW, LA	SEC D NORTH LEVEE 1ST LIFT	19881000	2,319	1,300
LMVD	LAROSE TO GOLDEN MEADOW, LA	SEC A EAST LEVEE 2ND LIFT	19890800	3,490	10
LMVD	LAKE PONTCHARTRAIN AND VICINTIY, LA	ALINEMENT N AIRLINE 1ST LIFT	19890100	25,870	3,000
LMVD	LAKE PONTCHARTRAIN AND VICINTIY, LA	STA 1121-1568 FINAL	19890100	4,250	2,250
LMVD	LOCK AND DAM 26, IL & MO	BURLNGTN-NORTHRN RR BRIDGE RM	19890100	1,850	1,619
LMVD	LOCK AND DAM 26, IL & MO	ACCESS ROAD MO SIDE GA	19890300	1,350	1,188
LMVD	LOCK AND DAM 26, IL & MO	REM EXIST STRUC DIKE CONST	19890400	11,988	1,700
LMVD	LOCK AND DAM 26, IL & MO	DAM THIRD STAGE	19890400	47,350	4,100
LMVD	L&D 26 SECOND LOCK, IL & MO	SECOND LOCK	19890400	185,400	10,337
LMVD	MISS RIVER SHIP CHANNEL, GULF TO BATON ROUGE, LA	MITIGATION WKS	19890600	15,622	3,372
LMVD	MISS RIVER BTWN OH & MO RVRS (REG WRKS), MO & IL	RED ROCK CHN PH2 MI 103-92	19890100	2,668	984
LMVD	MISS RIVER BTWN OH & MO RVRS (REG WRKS), MO & IL	KASKASKIA BEND PH2 MI 121-113	19881000	1,899	1,138
LMVD	NEW ORLEANS TO VENICE, LA	1ST ENLT STA 1567-1793	19881200	8,890	2,000
LMVD	OUACHITA AND BLACK RIVERS, AR & LA	NAVIGATION CHANNEL	19890700	5,695	439
LMVD	OUACHITA AND BLACK RIVERS, AR & LA	NAVIGATION CHANNEL	19890800	4,864	500
LMVD	RED RIVER WATERWAY, MISS RIVER TO SHREVEPORT, LA	BELOW GIN LAKE CAPOUT	19890200	2,314	2,012
LMVD	RED RIVER WATERWAY, MISS RIVER TO SHREVEPORT, LA	COTTON-MEADE CAPOUT	19890400	1,575	1,370
LMVD	RED RIVER WATERWAY, MISS RIVER TO SHREVEPORT, LA	ALEXANDRIA FRONT CAPOUT	19890200	2,150	1,869
LMVD	RED RIVER WATERWAY, MISS RIVER TO SHREVEPORT, LA	MONCLA REACH CAPOUT	19881100	4,483	3,899
MRD	WESTERLY CREEK, CO	WESTERLY CREEK EMBANKMENT	19881115	5,594	4,378
NAD	BALTIMORE HARBOR & CHANNELS, MD & VA	MARYLAND CHANNELS II	19890200	66,580	19,870
NAD	CAPE MAY INLET TO LOWER TOWNSHIP, NJ	GROINS	19890701	1,683	240
NAD	FRANCIS E. WALTER DAM, PA (MODIFICATION)	CLEARING	19881000	4,100	3,080
NAD	FRANCIS E. WALTER DAM, PA (MODIFICATION)	F&WL FACILITIES	19881000	1,500	410
NAD	FRANCIS E. WALTER DAM, PA (MODIFICATION)	PIPELINES (GAS & OIL)	19881000	4,800	2,380
NAD	FRANCIS E. WALTER DAM, PA (MODIFICATION)	CULTURAL MITIGATION	19890400	2,700	170
NAD	KILL VAN KULL AND NEWARK BAY CHANNELS, NY & NJ	CONTRACT NO 4	19890101	29,300	29,300
NAD	LOCK HAVEN, PA	PUMPING PLANTS	19890700	1,060	50
NAD	LOCK HAVEN, PA	BALD EAGLE CREEK	19890700	15,560	1,000

NOTE: CONTRACT AMOUNTS EQUAL TO OR GREATER THAN $1 MILLION

FY 1989 NEW CONTRACT AWARDS

895-149   26 MAR 88

DIV	PROJECT	DESCRIPTION	AWARD DATE YYYYMMDD	TOTAL CONTRACT COST $000	FY 89 ESTIMATED EXPEND $000
NAD	MORICHES INLET, NY	CHANNELS	19881201	1,985	1,985
NAD	RAMAPO AND MAHWAH RIVERS, NJ & NY	CHANNELS AND CANALS	19890201	3,408	135
NAD	RAMAPO AND MAHWAH RIVERS, NJ & NY	LEVEES AND FLOODWALLS	19890201	1,834	130
NAD	RICHMOND, VA	LEVEES SOUTHSIDE	19881100	11,900	4,975
NAD	RICHMOND, VA	PUMPS & SS DRAINAGE	19890500	7,650	815
NAD	RICHMOND, VA	N+S WALLS & CLOSURES	19890200	26,360	6,590
NAD	TAMAQUA, PA	TUNNEL	19890300	6,050	1,990
NCD	BASSETT CREEK, MN	UPSTREAM STAGE 2B	19890701	1,317	197
NCD	CHASKA, MN	CHASKA CREEK (STAGE 2B)	19890500	2,054	1,049
NCD	HANNIBAL, MO	LEVEES AND FLOODWALLS	19890630	2,890	280
NCD	HANNIBAL, MO	INTERIOR DRAINAGE FACILITIES	19890630	1,080	80
NCD	NORTH BRANCH CHICAGO RIVER, IL	SITE 29A RESERVOIR	19890600	2,877	849
NCD	NORTH BRANCH CHICAGO RIVER, IL	SITE 29A FLDWY & DIV STRUCT	19890600	1,058	150
NCD	SHEYENNE RIVER, WEST FARGO AND RIVERSIDE, ND	LEVEES	19890401	3,942	459
NCD	SHEYENNE RIVER, WEST FARGO AND RIVERSIDE, ND	CHANNELS	19890401	3,767	800
NCD	SHEYENNE RIVER, WEST FARGO AND RIVERSIDE, ND	RAILROAD BRIDGE	19890401	1,433	760
NCD	SOURIS RIVER BASIN, ND	LAKE DARLING DAM	19890601	7,375	2,180
NCD	SOURIS RIVER BASIN, ND	SAWYER	19890401	1,053	600
NCD	SOURIS RIVER BASIN, ND	LOCAL FLOOD WARNING SYSTEM	19890601	3,454	1,910
NCD	SOURIS RIVER BASIN, ND	RURAL IMPROVEMENTS	19890501	1,394	600
NCD	SOUTH FORK ZUMBRO RIVER AT ROCHESTER, MN	STAGE 1B	19890500	9,516	2,327
NCD	STATE ROAD AND EBNER COULEES, WI	STAGE 2 CHANNELS	19890701	10,873	3,284
NCD	UPPER MISS RVR ENV PROG, IL, IA, MO, MN, & WI	POOL 8 ISLAND CREATION	19890400	2,414	356
NPD	BONNEVILLE SECOND POWERHOUSE, OR & WA	DEVELOPMENT	19890400	1,500	397
NPD	BONNEVILLE NAVIGATION LOCK, OR & WA	LOCK CONSTRUCTION	19890100	68,148	18,970
NPD	BONNEVILLE NAVIGATION LOCK, OR & WA	D/S CHANNEL	19890100	30,862	3,162
NPD	BONNEVILLE NAVIGATION LOCK, OR & WA	PROJECT ROADS & BRIDGES	19890100	2,821	316
NPD	BONNEVILLE NAVIGATION LOCK, OR & WA	HATCHERY WELLS	19890100	2,544	2,544
NPD	BONNEVILLE NAVIGATION LOCK, OR & WA	U/S CHANNEL	19890100	1,272	105
NPD	BONNEVILLE NAVIGATION LOCK, OR & WA	PROJECT UTILITIES	19890100	1,361	105
NPD	CHIEF JOSEPH ADDITIONAL UNITS, WA	FINAL COMPLETION	19890200	3,180	790
NPD	LOWER SNAKE RVR F&W COMP, WA, OR, & ID	CW SAT TRAP & ACC CROOKED R	19890300	1,450	1,020

NOTE: CONTRACT AMOUNTS EQUAL TO OR GREATER THAN $1 MILLION

FY 1989 NEW CONTRACT AWARDS

89S-149   26 MAR 88

DIV	PROJECT	DESCRIPTION	AWARD DATE YYYYMMDD	TOTAL CONTRACT COST $000	FY 89 ESTIMATED EXPEND $000
NPD	LOWER SNAKE RVR F&W COMP, WA, OR, & ID	CW HAT CHINOOK & STEELHEAD	19890100	12,182	6,995
NPD	SNETTISHAM, AK	TRASH RACK	19890315	4,083	4,083
ORD	BIG SOUTH FORK NAT RIVER AND REC AREA, KY & TN	BURNT MILL RIVER ACCESS	19881000	1,075	1,075
ORD	EVANSVILLE, IN	STRINGTN RD TO US HWY 41 PT3	19881100	1,734	1,334
ORD	GALLIPOLIS LOCKS AND DAM, OHIO RIVER, WV & OH	PERMANENT OPERATING EQUIPMENT	19890700	3,250	100
ORD	MILL CREEK, OH	CHANNEL SEC 4B CENTR HILL RD	19881000	12,036	6,500
ORD	MILL CREEK, OH	LEVEE SEC 1	19890400	1,852	560
ORD	MILL CREEK, OH	CHANNEL SEC 1	19890400	10,236	4,500
ORD	PAINTSVILLE LAKE, KY	MINE FORK ROAD	19890300	2,000	500
ORD	TURTLE CREEK, PA	REPAIR & RESTORE CHANNEL	19890800	1,895	100
ORD	YATESVILLE LAKE, KY	RECREATION FACILITIES	19890200	11,800	1,450
SAD	B. EVERETT JORDAN DAM & LAKE, NC	NEW HOPE OVLK RECREA AREA	19890200	1,089	636
SAD	CENTRAL AND SOUTHERN FLORIDA, FL	L-74W & L-77	19890500	4,104	400
SAD	CENTRAL AND SOUTHERN FLORIDA, FL	S-251ABCD, S-254 & S-250ABC	19890500	1,418	400
SAD	CENTRAL AND SOUTHERN FLORIDA, FL	C-51 W END	19881200	4,591	500
SAD	CENTRAL AND SOUTHERN FLORIDA, FL	S-155A	19881200	1,769	500
SAD	CENTRAL AND SOUTHERN FLORIDA, FL	S-319 MACHINERY	19881200	10,230	1,500
SAD	CENTRAL AND SOUTHERN FLORIDA, FL	L-78 & L-79	19890600	8,375	500
SAD	CENTRAL AND SOUTHERN FLORIDA, FL	C-51 SUN STATE TNPK TO KIRK RD	19881100	4,648	1,200
SAD	CENTRAL AND SOUTHERN FLORIDA, FL	RCH#7 4M TAYLOR CREEK	19890300	5,340	200
SAD	CENTRAL AND SOUTHERN FLORIDA, FL	S-353	19890500	1,975	300
SAD	CENTRAL AND SOUTHERN FLORIDA, FL	S-96C & 96D	19890100	2,055	1,000
SAD	CENTRAL AND SOUTHERN FLORIDA, FL	C-120A&B (W/INLET STRS)	19890500	4,243	300
SAD	CENTRAL AND SOUTHERN FLORIDA, FL	RCH 2 (REM) 3.3 MS-PAHOKEE	19881000	1,460	1,000
SAD	CHARLESTON HARBOR, SC	REMAINING CHANNEL WORK	19890101	88,403	3,135
SAD	CHARLESTON HARBOR, SC	LOWER HARBOR	19881000	1,200	1,200
SAD	CHARLESTON HARBOR, SC	CHANNEL & CANALS	19890100	3,151	3,151
SAD	DADE COUNTY, FL	BAL HARBOUR & GOVT CUT	19890400	4,000	3,400
SAD	DUVAL COUNTY, FL	SEC 1	19890400	5,268	5,268
SAD	FALLS LAKE, NC	BEAVERDAM REC AREA	19881200	4,479	1,900
SAD	FALLS LAKE, NC	WELLS & SHINLEAF REC AREA	19890700	3,127	300
SAD	FALLS LAKE, NC	HOLLY POINT REC AREA	19881200	4,703	2,100

NOTE: CONTRACT AMOUNTS EQUAL TO OR GREATER THAN $1 MILLION

FY 1989 NEW CONTRACT AWARDS

89S-149 26 MAR 88

DIV	PROJECT	DESCRIPTION	AWARD DATE YYYYMMDD	TOTAL CONTRACT COST $000	FY 89 ESTIMATED EXPEND $000
SAD	FOUR RIVER BASINS, FL	FLATWOODS (REM) (PH VI)	19890500	3,120	420
SAD	MANATEE HARBOR, FL	MAIN CHNL, TRN BSN & WIDENING	19881000	10,960	6,100
SAD	OATES CREEK, RICHMOND COUNTY, GA	CHANNEL IMPROVEMENTS	19890301	7,400	630
SAD	PINELLAS COUNTY, FL	INDIAN SHORES BREAKWATER	19881200	1,768	1,768
SAD	PINELLAS COUNTY, FL	SAND KEY, INDIAN SHORES	19881200	12,753	6,000
SAD	PORTUGUES AND BUCANA RIVERS, PR	PHASE IV	19881200	7,444	3,349
SAD	PORTUGUES AND BUCANA RIVERS, PR	PHASE II	19881100	1,154	1,154
SAD	PORTUGUES AND BUCANA RIVERS, PR	ACCESS RD/SPILLWAY BRIDGE	19881000	2,850	1,000
SAD	RICHARD B. RUSSELL DAM AND LAKE, GA & SC	DREDGING TAILRACE	19890901	4,246	670
SAD	RICHARD B. RUSSELL DAM AND LAKE, GA & SC	ANTI FISH ENT (BAR RACKS)	19890201	4,160	1,160
SAD	THREEMILE CREEK, AL	CONTRACT II	19890115	2,030	2,030
SPD	CACHE CREEK SETTLING BASIN, CA	N, S, W, & TRNING LEVEES	19890500	6,000	2,200
SPD	CACHE CREEK SETTLING BASIN, CA	ALL CHANNELIZATION WORK	19890500	1,580	680
SPD	CORTE MADERA CREEK, CA	UNIT 4-FLOODWALLS	19890300	1,190	860
SPD	CORTE MADERA CREEK, CA	UNIT 4-DWNSTR SIR FRANCIS BL	19890300	1,320	880
SPD	LITTLE DELL LAKE, UT	OUTLET WORKS	19890300	11,090	4,370
SPD	LITTLE DELL LAKE, UT	QUARRY	19890300	4,030	3,800
SPD	LITTLE DELL LAKE, UT	MAIN DAM	19890300	19,910	4,110
SPD	OAKLAND HARBOR, CA	OAKLAND INNER/OUTER 42'	19881101	13,102	7,752
SPD	PHOENIX, AZ & VICINITY (STG 2)	ACDC CAVE CRK TO DREAM DRAW	19890300	30,048	18,661
SPD	REDBANK AND FANCHER CREEKS, CA	DETENTION BASIN	19890700	9,860	3,100
SPD	RICHMOND HARBOR, CA	CHANNELS	19890901	7,600	100
SPD	SACRAMENTO RIVER BANK PROTECTION PROJECT, CA	CONTRACT 42	19890300	7,770	4,295
SPD	SACRAMENTO RIVER DEEP WATER SHIP CHANNEL, CA	DEEP CHN-MI 41.5-MI 35	19881000	5,300	4,600
SPD	SAN LUIS REY RIVER, CA	FOUSSAT BRIDGE TO PRIORY	19890400	6,645	4,645
SPD	SANTA ANA RIVER MAINSTEM, CA	SEVEN OAKS DAM	19890400	274,788	1,900
SPD	SANTA ANA RIVER MAINSTEM, CA	R&R (LOWER SANTA ANA R)	19881000	29,423	6,900
SPD	SURFSIDE-SUNSET AND NEWPORT BEACH, CA	STG 9 (2.5 MIL CY)	19890900	7,960	1,700
SWD	ARCADIA LAKE, OK	PUBLIC USE AREA, STG III-B	19881201	5,400	1,125
SWD	BOGGY CREEK, AUSTIN, TX	CHANNELS PART II	19881000	10,836	7,228
SWD	COOPER LAKE AND CHANNELS, TX	MTGN AREA DEV COOPER LAKE	19890700	1,020	460
SWD	EL PASO, TX	PHELPS DODGE	19890301	5,820	1,970

NOTE: CONTRACT AMOUNTS EQUAL TO OR GREATER THAN $1 MILLION

FY 1989 NEW CONTRACT AWARDS

898-149 26 MAR 88

DIV	PROJECT	DESCRIPTION	AWARD DATE YYYYMMDD	TOTAL CONTRACT COST $000	FY 89 ESTIMATED EXPEND $000
SWD	FREEPORT HARBOR, TX	MAIN CHAN & BASINS	19890600	3,895	695
SWD	FREEPORT HARBOR, TX	REHAB S JETTY	19890600	17,562	1,562
SWD	MCCLELLAN-KERR AR RVR LOCKS & DAMS, AR & OK	CUTOFF LEVEE	19890400	5,977	4,087
SWD	MINGO CREEK, OK	MAINSTEM-MINGO CREEK	19890801	21,617	590
SWD	MOUTH OF COLORADO RIVER, TX	INSIDE NAV-JETTY ENTR CHAN	19881000	2,480	1,200
SWD	RAY ROBERTS LAKE, TX	REC FACILITIES PT II	19890100	10,622	5,653
SWD	RAY ROBERTS LAKE, TX	REC FAC PT III	19890600	11,349	1,500
SWD	RAY ROBERTS LAKE, TX	ALT REC FAC PT 3-LEWVLE LAKE	19881000	1,890	1,732
SWD	RAY ROBERTS LAKE, TX	RECREATION-LEWISVILLE	19890900	2,245	100
SWD	RIO GRANDE FLDWY, TRUTH OR CONSEQUENCES UNIT, NM	DAMS	19890101	11,750	4,280
SWD	SAN ANTONIO CHANNEL IMPROVEMENT, TX	PH III INTAKE & OUTLET	19890300	4,394	2,930
SWD	TAYLORS BAYOU, TX	HILLE STA 350-760 CHAN RECT	19890200	9,800	1,930
MRT	ATCHAFALAYA BASIN FLOODWAY SYSTEM, LA	CH TRAIN ABOVE MC	19881200	59,990	5,000
MRT	ATCHAFALAYA BASIN FLOODWAY SYSTEM, LA	E16.0 L/E	19881200	4,470	2,000
MRT	ATCHAFALAYA BASIN FLOODWAY SYSTEM, LA	W124 I-WALL	19890100	7,530	3,000
MRT	ATCHAFALAYA BASIN FLOODWAY SYSTEM, LA	EAST BAYOU SALE ELL/GORDY	19890600	13,926	200
MRT	ATCHAFALAYA BASIN FLOODWAY SYSTEM, LA	E-105 LEVEE ENLGT	19890300	8,750	3,000
MRT	CHANNEL IMPROVEMENT, AR, IL, LA, MS, MO & TN	FRITZ ISLAND, LA MI 338R	19890800	1,200	700
MRT	CHANNEL IMPROVEMENT, AR, IL, LA, MS, MO & TN	BELOW GRAND GULF,MS MI 399L	19881000	1,000	1,000
MRT	CHANNEL IMPROVEMENT, AR, IL, LA, MS, MO & TN	LELAND BAR, MS-AR MI 539R	19890700	1,100	300
MRT	CHANNEL IMPROVEMENT, AR, IL, LA, MS, MO & TN	TARPLEY CUTOFF, MS MI 540R	19890500	1,740	600
MRT	CHANNEL IMPROVEMENT, AR, IL, LA, MS, MO & TN	COMMERCE, MS	19890500	1,000	1,000
MRT	CHANNEL IMPROVEMENT, AR, IL, LA, MS, MO & TN	COTTONWOOD BAR, MS MI470R	19890600	1,400	700
MRT	HELENA HARBOR, PHILLIPS COUNTY, AR	CHANNEL, STAGE 1	19890800	38,769	5,500
MRT	MISS RIVER LEVEES, AR, IL, KY, LA, MS, MO & TN	ST GABRIEL M203-198L	19881015	5,240	3,213
MRT	MISS RIVER LEVEES, AR, IL, KY, LA, MS, MO & TN	GRETNA PHASE II M100-95R	19890415	4,698	1,064
MRT	MISS RIVER LEVEES, AR, IL, KY, LA, MS, MO & TN	RIDGELY BERM	19881000	1,607	1,200
MRT	MISS RIVER LEVEES, AR, IL, KY, LA, MS, MO & TN	AVONDALE FLOODWALL M108-107R	19890615	3,787	692
MRT	MISS RIVER LEVEES, AR, IL, KY, LA, MS, MO & TN	CACHE RVR PUMP STA (SUPPLY)	19890900	1,474	650
MRT	NONCONNAH CREEK, TN & MS	ITEM-1, MI 0.0-6.2	19890100	6,516	1,301
MRT	ST FRANCIS RIVER BASIN, AR & MO	SB HWY 61 MAIN DITCH 4.52	19890300	1,664	50

NOTE: CONTRACT AMOUNTS EQUAL TO OR GREATER THAN $1 MILLION

FY 1989 NEW CONTRACT AWARDS

89S-149 26 MAR 88

DIV	PROJECT	DESCRIPTION	AWARD DATE YYYYMMDD	TOTAL CONTRACT COST $000	FY 89 ESTIMATED EXPEND $000
MRT	ST FRANCIS RIVER BASIN, AR & MO	SB DITCH 9 4.91	19881000	1,173	50
MRT	ST FRANCIS RIVER BASIN, AR & MO	BELLE FOUNTAIN DITCH	19890700	1,153	100
MRT	TENSAS BASIN-RED RIVER BACKWATER, LA	ITEM 5B	19890700	2,000	300
MRT	WEST TENNESSEE TRIBS, TN	B SHARON IT 1 MFOR 0.0-7.6	19890400	2,151	813
MRT	YAZ BAS-DEMONSTRATION EROSION CONTROL, MS	2 HIGH DROP GCS	19890600	2,057	100
MRT	YAZ BAS-DEMONSTRATION EROSION CONTROL, MS	FW RETARDING STRUC 47 & 52	19890600	1,472	350
MRT	YAZOO BASIN - TRIBS, MS	SARDIS LOWER LAKE WEIR	19890100	1,715	880
MRT	YAZOO BASIN - TRIBS, MS	ITEM 2&3 GAP CLOSE	19890800	2,700	680
MRT	YAZOO BASIN - TRIBS, MS	ITEM 3	19890300	8,385	1,500
MRT	YAZOO BASIN-BIG SUNFLOWER, MS	2 CO BRIDGES ITEM 1B	19881000	1,210	210
MRT	YAZOO BASIN-BIG SUNFLOWER, MS	ITEM 66B SWAN LK MI 68.7-71.0	19890800	1,406	300
MRT	YAZOO BASIN-BIG SUNFLOWER, MS	ITEM 1B MI 0.0-12.0	19890800	4,047	600
MRT	YAZOO BASIN-MAIN STEM, MS	BEE LAKE CLOSURE	19890500	2,069	500

NOTE: CONTRACT AMOUNTS EQUAL TO OR GREATER THAN $1 MILLION

PLANNING ASSISTANCE TO STATES

Senator JOHNSTON. Provide for the record a breakout by State of the Section 22 request.

Mr. PAGE. The breakout by State is shown below.

STATE	FISCAL YEAR 1989 BUDGET REQUEST ($1,000)	STATE	FISCAL YEAR 1989 BUDGET REQUEST ($1,000)
Alabama	45	New Hampshire	30
Alaska	85	New Jersey	110
Arizona	95	New Mexico	120
Arkansas	100	New York	188
California	80	North Carolina	20
Colorado	45	North Dakota	130
Connecticut	50	Ohio	110
Delaware	110	Oklahoma	195
Florida	70	Oregon	100
Georgia	100	Pennsylvania	77
Hawaii	90	Rhode Island	20
Idaho	20	South Carolina	75
Illinois	115	South Dakota	15
Indiana	110	Tennessee	105
Iowa	135	Texas	150
Kansas	130	Utah	50
Kentucky	110	Vermont	25
Louisiana	105	Virginia	55
Maine	25	Washington	65
Maryland	75	West Virginia	100
Massachusetts	50	Wisconsin	100
Michigan	70	Wyoming	5
Minnesota	130	American Samoa	30
Mississippi	110	District of Columbia	15
Missouri	80	Guam	5
Montana	25	Northern Marianas	50
Nebraska	25	Puerto Rico	120
Nevada	25	Virgin Islands	25

FUNDING FOR RECREATION FACILITIES

Senator JOHNSTON. Provide for the record a list which shows the 1989 funding request for construction of recreation facilities in Construction, General. The list should be by project and amount.

Mr. PAGE. I will provide the requested table for the record.

FY 1989 FUNDING REQUEST FOR CONSTRUCTION OF RECREATION FACILITIES

	DIV	PROJECT	AMOUNT
1	LMV	RED RIVER WATERWAY, MISSISSIPPI RIVER TO SHREVEPORT, LA	$ 1,030,000
2	MRD	CHATFIELD LAKE, CO	138,000
3	MRD	LITTLE BLUE RIVER LAKES, MO	781,000
4	MRD	PAPILLION CREEKS AND TRIBS, LAKES, NE	2,657,000
5	MRD	MISSOURI NATIONAL RECREATIONAL RIVER, NE & SD	44,000
6	ORD	BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA, KY & TN	3,750,000
7	ORD	STONEWALL JACKSON LAKE, WV	9,950,000
8	ORD	TAYLORSVILLE LAKE, KY	456,000
9	ORD	YATESVILLE LAKE, KY	1,300,000
10	SAD	B. EVERETT JORDAN DAM & LAKE, NC	3,247,000
11	SAD	FALLS LAKE, NC	4,735,000
12	SAD	FOUR RIVER BASINS, FL	526,000
13	SAD	PORTUGUES AND BUCANA RIVERS, PR	577,000
14	SAD	RICHARD B. RUSSELL DAM AND LAKE, GA & SC	5,250,000
15	SPD	FAIRFIELD VICINITY STREAMS, CA	700,000
16	SWD	ARCADIA LAKE, OK	1,125,000
17	SWD	BOGGY CREEK, AUSTIN, TX	189,000
18	SWD	FOUNTAIN CREEK AT PUEBLO, CO	157,000
19	SWD	JOE POOL LAKE, TX	3,674,000
20	SWD	MOUTH OF COLORADO RIVER, TX	65,000
21	SWD	RAY ROBERTS LAKE, TX	11,417,000
		TOTAL	$51,768,000

RED RIVER WATERWAY

Senator JOHNSTON. Is the Corps of Engineers complying with the law as provided for in the Continuing Resolution for 1988, Public Law 100-202?

General HEIBERG. Yes, Sir. We are proceeding on schedule with the design of the nine channel improvement items which the law directed us to initiate in FY 1988. All nine items are scheduled for award this fiscal year. The design of Lock and Dams 4 and 5 is proceeding in accordance with the FY 1988 Appropriations Act on an accelerated schedule, and engineering and design funds have been programmed for this purpose.

LOCK AND DAM NO. 3

Senator JOHNSTON. The justification material indicates that initiation of Phase IIC has been delayed. What impact will this have on the overall schedule for construction of Lock and Dam 3?

General HEIBERG. That portion of the access road required for construction access is included in the Phase III contract for the main lock and dam structure. Phase II C contract is for construction of a portion of the access road that is not required for access to the construction site of the main lock and dam structure. The delay in award of the Phase II C contract will not impact the overall schedule for construction of Lock and Dam 3.

Senator JOHNSTON. What is the current status of action to award a continuing contract for Phase III construction of Lock and Dam No. 3?

General HEIBERG. Bid opening is scheduled for 17 March 88 and we plan to award by 31 March 88.

Senator JOHNSTON. The budget request for Lock & Dam No. 3 is only slightly ($3,000,000) more than the 1988 amount. Is there anything that you could be doing, but will not be able to do for whatever reaso to accelerate the completion schedule of Lock and Dam No. 3?

General HEIBERG. Capabilities are still under review. They will be provided as soon as they are available. The $3,000,000 that you refer to is the difference in the FY 1988 and FY 1989 funding for all work planned in Pool 3. The difference in funds for the Lock and Dam Phase III contract in these two years is approximately $7,200,000. The difference comes from completion of most of the pool work and reflects initiation of the lock and dam No.3 contract in mid-Fiscal Year 1988. The bid opening is set and completion time for construction of Lock and Dam 3 has already been set for a specified time and funds have been programmed based on this optimum schedule. We will, of course, continue to evaluate our future funding requirements once the contract is underway and the contractor has submitted his plan for construction.

Senator JOHNSTON. Are there any additional realignments, revetment, or bank stabilization items which are ready for initiation? If so, what are they and how much could be used to undertake the work in fiscal 1989?

General HEIBERG. Capabilities are still under review. They will be provided as soon as they are available. It should be noted, however, that we are proceeding on an optimum schedule, within our capabilities, with all of the work which has been directed by the various appropriations acts of recent years.

LOCKS AND DAMS NOS. 4 AND 5

Senator JOHNSTON. Congress provided $2,000,000 and directed the Corps to initiate an accelerated design schedule for Lock and Dams 4 & 5 so that Phase I construction could begin by April 1990. What has the Corps done to carry out this direction?

General HEIBERG. An Architect-Engineer contract for preparation of detail design and plans and specifications for Lock and Dam 4 is being awarded to enable concurrent design of both Locks and Dams 4 and 5. The schedule for completion of plans and specifications for Phase I for each Lock and Dam is December 1989. The schedule for completion of plans and specifications for Phase II for each Lock and Dam is October 1991.

Senator JOHNSTON. Does the budget request for 1989 for Engineering and Design maintain the schedule to initiate construction by April 1990 and complete construction in 1994?

General HEIBERG. Yes, Sir. The budget request for Fiscal Year 1989 has sufficient Engineering and Design funds scheduled to complete design so that construction could be initiated by April 1990. Construction of Locks and Dams 4 and 5 remains unscheduled.

Senator JOHNSTON. Is there anything from an engineering point of view that could be done in fiscal 1989 to accelerate the Engineering and Design or construction schedule of Locks and Dams 4 or 5?

General HEIBERG. The design of these structures is proceeding on an accelerated schedule, and adequate engineering and design funds have been programmed to meet this schedule. An Architect-Engineer firm has been hired to do the design work for Lock and Dam 4 and the design of Lock and Dam 5 will be done concurrently by in-house forces. We feel that the current schedule is optimum, from an Engineering standpoint, and will permit us to achieve the requirement in the FY 1988 Appropriations Act that construction could begin by April 1990.

Senator JOHNSTON. The funding profile supplied last year shows $1,176,000 to complete Wilkerson Point realignment in fiscal 1989. Why are no funds included in the 1989 budget for this item?

General HEIBERG. The contractor's progress has been greater than we anticipated, and completion is scheduled for FY 1988. Funds to accommodate the accelerated performance were made available from within the Red River Waterway project allotment using FY 1988 funds resulting from savings and/or slippage incurred on other construction items.

Senator JOHNSTON. Do you have the capability to begin work on any new work items (realignments, revetment, or bank stabilization measures) in 1989? If so, please provide the item and amount which could be utilized?

General HEIBERG. Capabilities are still under review. They will be provided as soon as they are available.

POOLS 1, 2, AND 3

Senator JOHNSTON. Are there any critical navigation items in Pools 1, 2, or 3 for which the Corps has additional capability? If there are, provide the item and the amount that could be utilized?

General HEIBERG. Capabilities are still under review. They will be provided as soon as they are available.

Senator JOHNSTON. Why is initial dredging above Alexandria in Pool 2 being excluded for the completion schedule as indicated in footnote 3? Is this work critical to navigation? If so, what level of funding could be used to undertake this work in 1989?

General HEIBERG. Initial dredging above Alexandria was excluded from the Pool 2 completion schedule because there will be no requirements for commercial navigation above the Port of Alexandria until completion of Lock and Dam 3. This item is critical for 9-foot navigation above Alexlandria and will be accomplished when appropriate. It would be more economical to delay dredging until Lock and Dam 3 nears completion due to possible natural channel erosion which would reduce quantities to be dredged and would also lessen the requirements for O&M funds to maintain the 9-foot channel.

FISH AND WILDLIFE MITIGATION

Senator JOHNSTON. Update the Committee on Corps activities related to fish and wildlife mitigation measures recently authorized in Public Law 99- 662.

General HEIBERG. Current Administration policy is to rely primarily on project and other public lands for mitigation, thus minimizing the Federal taking of private lands. The Chief of Engineers' report dated December 28,1984, is being reviewed to identify such opportunities and for consistency with Administration policies. Preparation of the Local Cooperation Agreement, real estate documents and acquisition are not scheduled at this time, and no funds are included in the FY 1989 request.

POOLS 3, 4, AND 5

Senator JOHNSTON. Are there any revetment or other work items remaining to be initiated or completed in pools, 3, 4, or 5 which could be accomplished in 1989 if funds were available? If so, provide the item and the amount which could be used.

General HEIBERG. No, Sir. We are proceeding at an optimum pace with all work which has been directed in recent appropriations laws. We have not scheduled the accomplishment of any work beyond that required by law.

Senator JOHNSTON. Is the District Engineer allowed to use amounts from savings and slippage to initiate new or apply to other on-going items?

General HEIBERG. No general savings and slippage requirements have been assessed to this project. It has been funded to the full extent of appropriations, as required in the Acts. If savings are realized, or slippages occur, they will be retained in the project allocation for the advancement of other scheduled work, as required by law.

NANPIL RIVER HYDROPOWER PROJECT
POHNPEI, FEDERATED STATES OF MICRONESIA

SENATOR JOHNSTON. On December 15, I wrote to General Heiberg requesting that the Corps' role in operating and maintaining the Nanpil River Hydropower Project in Pohnpei and training for Pohnpeians be contined for 4 additional years within the remaining funds provided for this project in P.L. 98-396. I believe this is critically necessary to protect the investment we have made in this project and to assure that Pohnpei has a project in good condition and which they can manage. I have not yet received a reply to this letter. Will the Corps commit to such a continuation for another 4 years?

GENERAL HEIBERG. The Corps has the authority to use the unexpended funds for project operation and maintenance for a limited time beyond the one year period envisioned at the time a Memorandum of Agreement between the Department of Army and the State of Pohnpei was executed in 1985.

SENATOR JOHNSTON. If not, what is the legal basis for the Corps' objection?

GENERAL HEIBERG. The Corps does not object to multiyear operation and maintenance and training of Pohnpei personnel for this project.

SENATOR JOHNSTON. Will report language directing the Corps to do so be sufficient to see that O&M and training continue for an additional 4 years?

GENERAL HEIBERG. Language directing an extension of the time period for Corps operation and maintenance of the project and training of Pohnpei personnel for an additional four years would be followed.

SENATOR JOHNSTON. Two of my staff members recently returned from a visit to Pohnpei where they had an opportunity to visit the Nanpil hydropower facility. Unfortunately the facility was shut down during that time because water flows were too low. Water diversions from other rivers would, of course, avoid such shut downs and result in a consistent and reliable power source.

I understand that such diversions are possible, a fact not known or fully appreciated when the initial plans and specifications were drawn up for this project. Moreover, I understand that the cost of designing such diversion structures would be around $350,000. Is this number correct?

GENERAL HEIBERG. Yes, sir. This is the most recent estimate that we have.

SENATOR JOHNSTON. Is it true, as my staff tells me, that there are sufficient funds remaining from the amount provided for this project in P.L. 98-396 to finance such designs?

GENERAL HEIBERG. Yes, sir. At this time, we estimate that approximately $800,000 will remain unexpended when the first year of operation and maintenance end in October 1988. However, the Corps is not authorized to use those funds for additional design.

SENATOR JOHNSTON. My staff also tells me that this project is not yet totally complete -- that technical adjustments and minor modifications in it are continuing to be made. If this is so, then why are diversion structures to increase water flows and avoid total periodic shutdowns of the project during dry spells not being vigorously explored --that is, why are such diversion structures not being designed with these funds as part of the ongoing work to make modifications and adjustments in the project?

GENERAL HEIBERG. This project was completed and dedicated in October, 1987 except for minor modifications as you note. Design of diversion structures would be well beyond the scope of minor modifications.

SENATOR JOHNSTON. What is the legal basis for this decision?

GENERAL HEIBERG. Public Law 98-396, the Second Supplemental Appropriations Act of 1984 appropriated $8 million to enable the Secretary of the Army, acting through the Chief of Engineers, to allow the construction of the project and operation, maintenance and training of personnel but did not authorize design of project expansion facilities.

SENATOR JOHNSTON. Are you aware that a feasibility study and a design in the traditional Corps meaning of those terms were never prepared, consistent with Public Law 96-205, the 1979 authorizing legislation which directed that this project be constructed, and that the clear legislative intent was that the project constructed maximize hydropower output, thereby maximizing alternatives to electricity generated by crude oil?

GENERAL HEIBERG. Yes. However, a reconnaissance study for this project was prepared by a private firm for Pohnpei. No feasibility study was performed. At the conclusion of the reconnaissance study, the Corps developed design analysis and plans and specifications for the project.

SENATOR JOHNSTON. Why is this clear legislative history, which by the way dates to 1974, not sufficient to allow you to proceed?

GENERAL HEIBERG. The legislation does not authorize the design of project expansion facilities.

SENATOR JOHNSTON. Would report language directing you to proceed be sufficient to require you to proceed?

GENERAL HEIBERG. Report language would not be sufficient to direct us to proceed with expanding this project where there is no previous authorization.

SENATOR JOHNSTON. If not, what is the legal basis for your position and what would be required?

GENERAL HEIBERG. The legal basis is that there is no authorization to expand this project. Such authorization would be required.

SENATOR JOHNSTON. Is bill language necessary?

GENERAL HEIBERG. Yes. Bill language authorizing and directing the Secretary of the Army to proceed with expansion of the project would be required. Our ability to proceed would depend upon the availability of funds at that time.

RICHARD B. RUSSELL DAM & LAKE, GA & SC

Senator JOHNSTON. There is concern in Georgia and South Carolina regarding the potential for major fish kills as the result of operating the pumped storage unit at the Richard Russell project. Please bring the committee up to date on this problem.

General HEIBERG. We have decided to continue with two contracts related to pump storage operation at the Richard B. Russell project — the construction of pump storage turbines, awarded May 22, 1984; and the construction of pump storage generators, awarded 31 October 1986. This decision was based on a detailed evaluation of conditions at Richard Russell. We believe pump back operation and maintaining an acceptable fishery can both be achieved.

Senator JOHNSTON. What actions are being taken so there is not a repeat of the situation that happened at the Harry S. Truman project in Missouri?

General HEIBERG. Since 1982, the Savannah District has been investigating the circumstances surrounding the fish kill that occurred during three hours of pumpback testing at the Harry S. Truman Dam, with a view toward comparing conditions at Truman with Richard B. Russell. We have compared types of generating units, tailrace dimensions, methods of project operation, and fishery data and concluded that conditions are quite different. We do not anticipate unavoidable significant adverse impacts at the Richard B. Russell project. The result of the studies will be presented in a Supplemental Environmental Impact Statement, which will be coordinated in draft form in the summer of 1989.

Senator JOHNSTON. We have been studying the Truman problem since 1982 with no resolution -- why are we moving ahead with such speed ($32,000,000) on the Russell project?

General HEIBERG. The Truman project is only one of many pump storage projects operating in the country. We are familiar with the Carter's Dam project in Georgia, Duke Power Company's Keowee-Jocassee project, and Georgia Power Company's Wallace Sinclair Project near Milledgeville, Georgia. All are pumpback projects which are operating with no significant adverse impacts on fisheries. Due to the studies conducted at the Russell project, with no apparent significant adverse impacts on the fishery, and the high economic return on the pumpback operation, it is prudent to proceed expeditiously.

Senator JOHNSTON. What specifically accounts for reprogramming $7,301,000 from the project?

General HEIBERG. Section 901 of the Water Resources Development Act of 1986 imposed obligation ceilings on the combined Construction, General appropriation and the construction component of the Flood Control, Mississippi River and Tributaries appropriation for 5 years. The ceilings went into effect in FY 1987 with a limit of $1.4 billion and increase to 100 million each year through FY 1991 when the ceiling will be $1.8 billion. In order to maximize our utilization of the available Construction, General obligation ceiling, funds were reprogrammed within the guidelines established for reprogramming actions to continuing projects such as Richard B. Russell. This increase in funds available in Fiscal Year 1987 allowed an offsetting reduction in Fiscal Year 1988 amounts.

Senator JOHNSTON. Are there any actions which can be taken to slow down work on the pumped storage aspects of this project pending resolution of the fish kill problem? How would they affect the use of the $32,000,000 budget request for 1989?

General HEIBERG. We would recommend that the project proceed as programmed. The $32 million for Fiscal Year 1989 includes $12 million for the on-going pump storage contracts. These contracts could be terminated, but no substantial saving would result. An additional $5 million in Fiscal Year 1989 earnings is programmed for the pump storage powerhouse contract, not yet awarded. Remaining items are not related to pumped storage construction.

Senator JOHNSTON. What impact would a complete moratorium have in the way of increased costs?

General HEIBERG. The "sunk" costs which would be lost were this action taken include $26 million for turbine and generator contracts and $4 million in fishery impact studies. Total annual net benefits attributable to installation and operation of the pump turbines is estimated as $63 million per year, or about $7 thousand per unit per day. These funds would be returned to the U.S. Treasury from power marketing revenues and would not be available if the project were terminated.

Senator JOHNSTON. Is the full use of the budget request contingent upon the outcome of any fish studies? If so, provide for the record a list of the specific work and amount which which could not be used if the studies are delayed?

General HEIBERG. Sir, full use of the budget request is not contingent upon the outcome of any fish studies. We expect to fully utilize the budgeted funds and proceed with the project as programmed.

OAKLAND HARBOR, CALIFORNIA

Senator JOHNSTON. Progress on the Oakland Harbor deepening has been slowed because of concerns with the dredge disposal site expressed by U. S. Fish and Wildlife and EPA. Bring the Committee up to date with this problem.

General HATCH. Sir, the U.S. Fish and Wildlife Service, EPA and others have objected to the planned disposal of dredged material from the Oakland Harbor deepening at the San Francisco Bay disposal site near Alcatraz Island. We are coordinating with those agencies and are currently investigating two alternative disposal sites in the ocean. One site is about 16 miles southwest of the Golden Gate where the water is about 150 feet deep, and the other is about 25 miles southwest of the Golden Gate where the water is about 300 feet deep. A technical review panel, consisting of five technical experts each from the EPA and the Corps, will meet in Washington, D.C. on March 10-11, 1988 to review the merits of the two alternative sites. If the panal agrees on an acceptable site, the Corps will proceed with the project Final Environmental Impact Statement processing to EPA and the public, immediately. If no site is agreed to, a delay could result, pending the identification of an acceptable site. I will provide for the record any additional information which becomes available on this subject prior to the closing of the record.

[The information follows:]

As noted in General Hatch's testimony before this Subcommittee on March 2, 1988, a panel composed of technical experts from the EPA and the Corps was convened on March 10 - 11, 1988 to review the merits of alternative ocean disposal sites for Oakland Inner Harbor dredged material. The panel's findings were that disposal at the 16 mile site would likely have greater potential for disruption of fishing activities than disposal at the 25 mile site. Further, the panel found that additional biological testing within the project area should be performed prior to disposing of the material from the ultimate Federal project deepening (to -42' MLLW) in the ocean. Consequently, the panel recommended that construction of a portion of the project should proceed with disposal at the 25 mile site, and that performance of the disposal should be monitored for possible use in subsequent disposal options for the balance of the Oakland project.

The portion of the project recommended for initial construction by the Division Engineer consists of dredging a portion of the Inner Harbor channel and proposed turning basin to -38' MLLW. The project sponsor, the Port of Oakland, has proposed construction of this portion pursuant to a Section 215 agreement. The Port requires this increment to accommodate the new generation of container vessels being used by American President Lines (APL). The Port has contracted with APL for arrival of these vessels in Oakland in the first week of June 1988, and has committed more than $70 million in infrastructure improvements to accommodate these vessels and their cargo. To meet this date, construction would have to begin in late April.

A Supplemental EIS for the Federal project was filed with EPA on March 17, 1988 expressing the Corps intent to proceed with the Corps/EPA technical review panel recommendations for the initial construction. The public review process associated with this document dictates that the Record of Decision on the SEIS for the Federal project cannot be signed prior to the end of April. Thus it is not possible to accelerate our current schedule to execute a Federal construction contract in time to meet the Port's June goal, making a 215 agreement the Port's only option to meet this goal.

While the cost of this initial construction project will increase as a result of the change in the disposal site, funding requirements for Fiscal Years 1988 and 1989 will not change. Funds currently available in FY 1988 appear adequate for the Federal share of costs. Initiation of deepening to 42 feet, requiring the removal of 6.5 million cubic yards of material, will be delayed pending completion of additional technical testing as well as evaluation of practicable disposal alternatives for this material. Accordingly, the dredging work for the remainder of the project could be initiated as late as spring 1989.

Senator JOHNSTON. What would be the impact on use of the $10,000,000 requested for 1989 if EPA approval of a disposal site is not provided by April 1, 1988 as indicated in the justification material?

General HATCH. Sir, there would be no impact on the use of funds requested for FY 1989 if the EPA approval could be obtained by July 1988, and we are reasonably certain that we can reach agreement before then.

Senator JOHNSTON. Is any of the dredge spoil contaminated? If so, will your construction schedule and funding needs to be impacted?

General HATCH. Sir, our studies to date indicate that only about four percent of the material to be dredged is contaminated. We do not anticipate any changes will be required in either the schedule or the costs due to the contaminants.

LITTLE DELL LAKE, UTAH

Senator JOHNSTON. An amount of $3,000,000 was provided for the Little Dell project in Utah based on information that the Corps could use the full amount to keep the project on schedule. What has caused the delay in proceeding with this project, thereby reducing the 1988 funding requirement to $1,750,000?

General HATCH. Sir, the FY 1988 funding was reduced to $1,750,000 because we were able to reporgram an additional $1,250,000 to the Little Dell project late in FY 1987, to remain available for FY 1988, from surplus funds at other projects. We did experience some delay in the project because we had to change the design of the outlet works intake structure and the Parleys Creek Diversion pipeline, but those delays did not impact the $3,000,000 provided for the current year.

Senator JOHNSTON What is the schedule for awarding the main dam construction contract?

General HATCH. Sir, we expect to award the main dam core trench excavation and test fill contract in May 1988 and the main dam construction contract in March 1989.

FRANCIS E. WALTER DAM

QUESTION: Update the Committee on the issue related to the water supply cost on the project including any changes in the cost sharing arrangement.

ANSWER: Last year's non-Federal share of costs allocated to water supply was based on a single-purpose water supply alternative at the project site. A review of the project cost allocation determined that costs allocated to water supply should be based on development of water supply at the least costly alternative site. This change resulted in increasing the non-Federal share for water supply. Furthermore, since section 103(c)4 of the Water Resources Development Act of 1986 set the non-Federal share of costs allocated to recreation at 50% of separable recreation costs only, and last year's non-Federal cost was based on 50% both joint and separable recreation costs, the Federal share of the costs allocated to recreation has increased.

QUESTION: Could you explain the need to reprogram $1,430,000 into the project and how will the funds be used?

ANSWER: The funds will be used for real estate acquisition, and to start construction on utility and highway relocations, the dam and appurtenant works, and the operation and maintenance building. However, these funds cannot be spent until the local cooperation agreement has been executed.

QUESTION: Was Committee approval provided?

ANSWER: At this point in time, only $870,000 has been allocated to this project for Fiscal Year 1988. This represents the $1,000,000 conference allowance minus $130,000 assigned as Savings and Slippage. We expect to execute the local cooperation agreement this summer. We will, at that time, reassess our remaining requirements for Fiscal Year 1988 and advise the Committee of any plans to reprogram any funds needed in excess of our reprogramming authority.

BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA, KENTUCKY AND TENNESSEE

Senator JOHNSTON. Bring the committee up to date on the Big South Fork National Recreation Area in Tennessee.

General HEIBERG. The Big South Fork National River and Recreation Area project in Kentucky and Tennessee was authorized by the Water Resources Development Act of 1974 for $33 million at full Federal cost. The project purposes were preservation of the scenic area, public recreation, and the stimulation of the local economy. The Water Resources Development Acts of 1976 and 1986 increased the cost to $103,522,000 and $156,522,000, respectively. All work scheduled for completion within the $103,522,000 ceiling, to include purchase of 103,000 acres of land, road construction, and the Blue Heron and Bandy Creek Recreation Areas in Kentucky and Tennessee, has been fully funded and is scheduled for completion in April 1989.

Senator JOHNSTON. Does the $4,500,000 requested for fiscal 1989 make any new commitments or initiate any new items for which budgetary resources will be needed in future years?

General HEIBERG. There are no new budgetary commitments incurred with the $4.5 million requested in the Fiscal Year 1989 budget, nor are we initiating any new item of work for which budgetary resources will be needed in future years. The $4.5 million is necessary to complete facilities already constructed or under construction and to make them reasonably operable and productive by themself.

Senator JOHNSTON. Will any funds be used for any features contained in section 1110 of P.L. 99-662?

General HEIBERG. No funds will be used for construction of additional facilities included in section 1110 of P.L. 99-662, which includes construction of the Bear Creek Recreation Area in Kentucky and the Ruby Recreation Area in Tennessee and the purchase of additional land, until a non-Federal sponsor is willing to cost share the remaining cost on a 50% Federal and 50% non-Federal basis.

QUESTIONS SUBMITTED BY SENATOR DOMENICI

ACEQUIAS IRRIGATION SYSTEM, NM

Senator DOMENICI. I wish to direct your attention to Section 1113 of Public Law 99-662, the 1986 Water Resources Development Act. This is the section that authorizes work to restore acequia systems in New Mexico, the sum of $1.7 million was appropriated for the current fiscal year to initiate construction on these small projects, with non-Federal interests required to provide an additional 25 percent or $567,000.

The only thing holding up construction on the top-priority projects, as I understand it, is the approval in Washington of the Local Cooperation Agreement, which has been approved by non-Federal interests. I urge you to do everything that you can to push that approval along quickly, so that we can move into construction this spring.

As I understand it, the Corps has a capability to spend $4 million in Federal funds during the 1989 Fiscal Year on the acequias renovation effort, money that would be matched by $1,670,000 in non-Federal funds. Would you please describe for the record the work that would be undertaken with this additional capability, should the funds be appropriated?

Mr. PAGE. Capabilities are still under review and they will be provided for the record as soon as they are available.

Senator DOMENICI. What work will be undertaken with the funds already appropriated?

Mr. PAGE. The allocation of $1,700,000 has been reduced by $222,000 for the project's equitable share of assigned savings and slippage. As soon as the Local Cooperation Agreement is executed, the $1,478,000 will be made available to initiate and complete construction of as many of the acequia projects as is possible. This is presently estimated to be about ten projects.

MIDDLE RIO GRANDE FLOOD PROTECTION, BERNALILLO TO BELEN, NM

Senator DOMENICI. Another project that was approved in the 1986 bill was one called Middle Rio Grande Flood Protection, Bernalillo to Belen, which had a total cost listed of $44.9 million, 25 percent provided by non-Federal interests.

As I understand it, this project is ready to go into construction, and the District had budgeted $2 million to initiate construction in fiscal 1989. Is that correct?

Mr. PAGE. The Albuquerque District made an initial recommendation for initiation of construction on this project.

Senator DOMENICI. Does the Corps have the capability to begin this important project, if funds are appropriated?

Mr. PAGE. Capabilities are still under review and they will be provided for the record as soon as they are available.

Senator DOMENICI. I should note that the potential local sponsor of the project we call the Albuquerque Levees has not yet signed a local cooperation agreement. But I am assured that such an agreement is almost certain to be signed soon after Federal funds are appropriated. Is it correct that the Corps, in other cases, has asked for new construction funds and has received Congressional add-ons for new construction work prior to the completion of the necessary Local Cooperation Agreement?

Mr. PAGE. Although a Local Cooperation Agreement has not been executed, funds can be requested and appropriated for a new construction start. However, funds are not allocated to the field for any land acquisition or construction activities until a Local Cooperation Agreement has been executed. Allocation of funds can occur almost immediately following this event.

RESPONSES TO QUESTIONS SUBMITTED TO THE BUREAU OF RECLAMATION

Senator JOHNSTON. I understand that the staff has some questions whichwill be submitted to the Bureau of Reclamation. The responses to those questions will be incorporated in therecord at this point.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR JOHNSTON

Construction

Question. How many projects for which FY 1989 funds have been requested have a total estimated cost which is greater than the appropriation ceiling?

Answer. We currently have 9 projects which have a total estimated cost greater than the current appropriation ceiling. In fiscal year 1989, we will not be making any commitment of funds that would be in excess of the authorized ceiling. The projects are:

Central Valley Project: Auburn-Folsom South Unit, San Felipe Division, and San Luis Unit (Federal and Joint Use and Distribution and Drainage System authorizations);

Colorado River Basin Salinity Control Projects: Title I Division and Title II Division;

Colorado River Storage Project (Public Laws 84-485 and 92-370), (Public Law 90-537, Dallas Creek, Animas-La Plata, Dolores, San Miguel, and West Divide);

Pick-Sloan Missouri Basin Program: Garrison Diversion Unit;

WEB Rural Water Development Project;

San Luis Valley Project (SLVP), Closed Basin Division; and Washoe Project.

The SLVP, Closed Basin Division is the only one that requires legislation to increase the appropriation ceiling in FY 1989 before the full requested amount can be expended.

Question. It is noted that two major construction projects, Brantley and Headgate Rock have slipped completion dates. Please explain why these two projects were not kept on schedule.

Answer. On the Brantley Project, the completion date has slipped to FY 1990 because of a newly identified requirement to clear salt cedar trees from the McMillan Reservoir area.

The Headgate Rock Hydroelectric Project has been delayed one year because of formal protests against award of the powerplant prime contract. Specifications were reissued and the contract was awarded in April 1988. Project completion is now scheduled for FY 1992.

Question. Last year the Secretary of the Interior testified that the Bureau plans to return funds to construction projects that were delayed in FY 1988. How much has been provided in the FY 1989 budget for putting the delayed projects back on more efficient schedules?

Answer. Total funding for the delayed projects is $130 million, of which $42 million is for new work that allows 10 more projects to be placed on more efficient schedules. Shown below is a table of those projects:

($ x 1000)

	Project			FY 1989		
			FY 1988	Ongoing	New	Total
	Title I Division, CRBSCP		23,984	20,027	0	20,027
	Animas-La Plata Project		3,000	1,832	149	1,981
*	Columbia Basin, Irrig,		3,700	2,343	1,587	3,930
	CVP, Auburn-Folsom South		1,000	1,500	0	1,500
	Pick-Sloan Missouri Basin:					
*	Belle Fourche Unit		980	3,358	842	4,200
	North Loup Division	1/	20,470	14,596	180	14,776
	O'Neill Unit		500	600	0	600
	Boulder Canyon Project		1,415	0	0	0
*	Paradox Valley Unit, Title II		11,383	7,644	60	7,704
*	Grand Valley Unit, Title II		8,525	4,215	3,444	7,659
	San Luis V., Closed Basin	2/	4,085	5,215	5,106	10,321
	CVP, San Felipe Division	3/	7,000	500	0	500
*	Dolores Project		11,047	15,772	10,616	26,388
	Arbuckle, D&MC		580	0	0	0
*	CRFW&LS, D&MC		7,300	4,601	7,470	12,071
	Cultural Resource Activ, D&MC		50	50	0	50
	Leadville Mine Drainage, D&MC		50	200	0	200
*	Lower Colo Water Supply, D&MC		0	60	470	530
	Oahe Unit, D&MC		65	65	0	65
*	Velarde Community Ditch,D&MC		717	805	1,630	2,435
*	Weber Basin, D&MC		124	360	1,134	1,494
*	Sect 8 (excluding Dallas Creek)		1,991	4,458	9,042	13,500
	TOTAL-DELAYED		107,966	88,201	41,730	129,931

* Previously delayed; back to more efficient schedule in FY 1989.
1/ Delay relates only to Davis Creek Dam facilities.
2/ Only Stage 3 facilities delayed.
3/ Only Watsonville Subarea facilities delayed.

Question: What is the current status of Reclamation activities and funding related to the Kesterson Reservoir? How would funding plans be impacted if it is decided to change to a combination wet-flex/biological-treatment approach?

Answer: The Department of the Interior continues to voluntarily cooperate with the California Water Resources Control Board decision of March 19, 1987, for the cleanup of Kesterson Reservoir using the Onsite Disposal method. On January 28, 1988, the Bureau of Reclamation began dewatering the reservoir ponds in preparation for excavation of sediments and vegetation and for construction of the landfill. Construction bids were opened on March 7, 1988, and it was anticipated that the contract would be awarded in early April 1988. Because of recent Congressional concerns regarding the long-term effectiveness and budgetary requirements of implementing Onsite Disposal, the Bureau has temporarily delayed award of the construction contract. As requested by the Congress, the Bureau requested that the State Board for reconsider its order requiring onsite disposal for the cleanup of Kesterson Reservoir; it is anticipated that the Board will consider the Bureau's request at its mid-May meeting. Until further notification is received from the State Board on the cleanup approach to be adopted, the Bureau will continue to support interim management requirements and, to the extent possible, measures necessary to maintain the viability of the onsite disposal option.

If the construction contract for Onsite Disposal had been awarded on April 1, 1988, activities in FY 1988 would have included construction of the landfill at the reservoir, removal of sediments from the San Luis Drain, continuation of monitoring at both Kesterson and the Drain, and continued nuisance abatement in order to meet the 1988 completion date specified in the State Board Order. The Bureau has adequate funding ($21,866,000) available for FY 1988 activities for the cleanup using Onsite Disposal. The FY 1989 request of $13,945,000 would still be required for continuation of planned construction (including sediment removal from San Luis Drain), monitoring and evaluation, and nuisance abatement if Onsite Disposal were implemented.

At this time, FY 1989 funding needs for Kesterson cleanup using a strategy other than onsite disposal cannot be estimated until the Board has issued a decision on the Bureau's request (anticipated not earlier than mid-June 1988).

Question: Would you please provide this Committee with a current summary of San Joaquin Valley Drainage Program activities, accomplishments, and schedules?

Answer: The San Joaquin Valley Drainage Program is investigating the problems associated with the drainage of irrigated agricultural lands on the west side of the San Joaquin Valley and formulating, evaluating, and recommending alternatives for the immediate and long-term management of those problems. Plans are being developed for the 5 subareas that comprise the Program principal study area. The principal study area is defined as those lands currently affected by problems related to agricultural drainage, as well as lands likely to be affected in the future, and include both State and Federal water project service areas.

The Drainage Program is continuing to support research efforts that contribute to solving drainage and related problems and are responsive to the time requirements of regulatory agencies, landowners, and resource managers. Current activities are focusing on specific geohydrologic conditions in the valley, agricultural drainage contamination of the environment, toxic effects of agricultural drainage substances of concern on fish and wildlife, potential drainage-related risks to public health, irrigation and drainage technology, and drainage water treatment and disposal.

A summary of Drainage Program accomplishments to date follows:

Geology and Hydrology: Geohydrologic investigations of the land and waters of the San Joaquin Valley and its subsurface materials have revealed the source, mobility, and occurrence of the toxic trace elements (such as selenium) and salts that have caused the environmental contamination at Kesterson Reservoir and which have the potential to cause additional environmental problems and continuing economic problems in several parts of the western valley. Scientific studies have shown the direct relationships between irrigation of arid soils, leaching of minerals to form high concentrations in groundwater, the gradual rise of groundwater so that such lands become water-logged during part of the year, the installation of drainage systems to improve agricultural conditions, and the subsequent outflow to streams and ponds of drainage water containing contaminants. Current work emphasizes completion of studies that fill important gaps in understanding the subsurface conditions, and the operation of mathematical models to enable planners and managers to determine the feasibility of various drainage water management options, e.g., lowering groundwater tables through pumping of deep wells.

Fish and Wildlife: Several contamination field surveys and related assessments of effects on wildlife, as well as a number of toxicological studies on the effects of agricultural drainage water contaminants on fish and wildlife resources, have been conducted and are underway in the San Joaquin Valley. These efforts are providing critical information regarding the geographic extent and severity of contamination, the independent effects of contaminants other than selenium (e.g., boron and arsenic), and the interactive effects (both synergistic and antagonistic) of multiple contaminants.

Scientific understanding of both safe and toxic concentrations of contaminants in the environment and diet of fish and wildlife has greatly improved. Laboratory studies have shown that some agricultural drainage water contaminants (especially selenium and boron) are far more toxic to fish and wildlife than earlier believed.

A study has been initiated to develop and evaluate techniques to restore fish and wildlife habitats contaminated by agricultural drainage water. Studies are underway to assess the biological and economic effects of San Joaquin Valley agroforestry plantations. Private landowners and managers have been provided technical assistance in managing water, wetlands habitat, wildlife populations, and public hunting and fishing to take into consideration potential contaminants in inflow waters.

Public Health: Scientific investigations of public health conditions in the San Joaquin Valley, relative to agricultural drainage waters, have not identified existing adverse health effects due to drainage waters. However, studies are showing the dimensions and details of conditions under which public health problems could arise and the preventative actions that may need to be adopted. A review continues of all possible exposure pathways for the fairly broad suite of contaminants found in some valley drainage waters. Possible low-level chronic effects of trace elements in drainage water are being examined.

Treatment, Reuse, and Disposal: Through technical analyses, a comprehensive list of potential, feasible treatment and disposal processes has been narrowed to several methods now under investigation for their effectiveness in removing selenium, boron, and salts from drainage waters. Eight remaining treatment processes are being evaluated and field tested. A joint Federal/State/local field station is planned for implementation in FY 1989 in order to centralize all ongoing efforts to develop a workable technology. It is estimated that, with concentrated joint efforts, a breakthrough in treatment technology which could handle a significant part of the contaminant and salt load in the valley is 5 to 10 years away.

Studies on in-valley disposal of drainage waters are focusing on evaporation ponds, deep-well injection, and discharge to surface streams. An interagency task group is developing technical criteria for the design and study of evaporation ponds. Studies are also underway in characterizing the biological and physical/chemical aspects of evaporation ponds. An engineering evaluation of deep-well injection for the disposal of drainage waters was completed in 1986. The disposal of drainage to surface waters will depend on effluent discharge standards and stream objectives which are presently being revised by the State regulatory agency and are scheduled to be established by the end of 1988. Evaluation for surface water disposal will be influenced by these revised regulatory requirements.

Studies on reuse of drainage water for agricultural crops and agroforesty have been in progress. The University of California is leading in these studies which focus on salt-tolerant crops and trace element uptake. The growing of salt-tolerant trees has been demonstrated at the field level. The harvesting of biomass when the demonstration crops have reached maturity will permit the evaluation of this approach on the reuse of drainage water.

On-Farm Water Management: Combined work in agricultural engineering, hydrology, and economics has established that improvements in on-farm use of water currently represent the most feasible approach in reducing drainage water contamination problems, as well as reducing the problems of in-situ damage to crops from salts, boron, and high water. Various studies, some of which are analyzing field conditions, have led to an understanding of the physical and economic conditions under which a water user has alternatives to change land and water management practices in order to lessen the contaminant load in drainage waters. Cooperative efforts continue with growers and related organizations.

Data Management: Computerized data bases have been developed for a variety of program activities. These include bibliographies for Drainage Program staff use, a listing of Program-related projects, and the implementation and documentation of the GIS (Geographic Information System) which is operational. The GIS is an integration of spatial (map data) and associated data files (e.g., population, vegetation, etc.) in a computer data base system. The quality assurance/ quality control program for water quality sampling and analysis has been implemented.

Plan Formulation: A preliminary model to analyze and evaluate agricultural and wetland habitat production, hydrology and salinity has been developed to simulate agricultural and wetland management options available for the western San Joaquin Valley. A draft plan formulation and evaluation technical report has been prepared that presents the planning process and, for illustrative purposes, discusses the preliminary plans for one of the study subareas.

Public Involvement: A Citizens Advisory Committee, composed of 14 representatives of key interests, was formed under State charter in 1987 to provide advice on the decisions to be made in the Drainage Program and on the pubic involvement program. A Public Involvement Plan was completed in January 1988 and includes 3 series of public meetings, to coincide with significant decision points in the development of alternatives and preparation of the final plan(s). Public information activities to date have included publication and distribution of a variety of technical reports, scientific manuscripts and articles, and quarterly status reports. The Citizens Advisory Committee will sponsor various meetings and workshops and will take the lead in public participation activities for the Drainage Program.

Potential management options identified to date include a broad array of both structural and nonstructural approaches to solving the drainage and related problems of the western San Joaquin Valley. The options include 8 interrelated categories: on-farm water management, fish and wildlife measures, shallow groundwater management, land use changes, drainage water treatment, drainage water reuse, drainage water disposal, and regulatory and institutional changes. In December 1987, the Program published a report titled "Developing Options: An Overview of Efforts to Solve Agricultural Drainage and Drainage-Related Problems in the San Joaquin Valley." As discussed in that report, potential drainage water management options identified to date involve:

On-Farm Management of Agricultural Drainage Water: Among the most promising on-farm techniques to reduce drainage volume are precise scheduling of irrigation, improving water application uniformity, recirculating field runoff (tailwater), and reusing subsurface drainage where possible.

Fish and Wildlife Measures: Four types of alternatives to solve drainage-related impacts on fish and wildlife and to achieve program objectives are being developed and evaluated:
(1) protection of existing resources to ensure that further contamination and other damage does not occur (this includes mitigation); (2) restoration of habitat and other fish and wildlife values damaged by agricultural drainage water; (3) provision of adequate, firm, clean, freshwater supplies for both wildlife areas and instream flow uses that previously relied upon or were impacted by agricultural drainage water; and (4) identification and evaluation of opportunities to mitigate fish and wildlife resources consistent with identified public needs.

Shallow Groundwater Management: Managing shallow groundwater levels on a district or regional scale may provide effective means to solve drainage problems in some areas of the valley with a high groundwater table . The physical possibilities of district or regional groundwater management and conjunctive use of groundwater and surface water are being investigated. Studies on groundwater conditions and movement in the study area have provided improved knowledge of groundwater characteristics. The results from these studies are vital in the design and evaluation of options for managing groundwater to remedy drainage and related problems.

Land-Use Changes: Several options for change from intensive irrigation of cropland to other uses show promise in helping to solve drainage and related problems. Those being investigated are changes in cropping patterns, conversion of cropland to wildlife habitat or open-space areas, and idling selected areas of irrigated cropland.

Drainage Water Treatment: Eight treatment technologies evaluated to date have demonstrated the best potential for use in the valley: (1) bacterial treatment, (2) iron-filing adsorption, (3) iron-hydroxide precipitation, (4) microalgal/bacterial treatment, (5) ion-exchange resins, (6) in-situ volatilization from soil, (7) chemical/physical attenuation in soil, and (8) reverse osmosis/desalting.

Drainage Water Reuse: Theoretically, drainage water could be reclaimed for a wider variety of uses; however, they would require removal of certain pollutants and/or toxic elements and would generally involve expensive treatment processes.

Drainage Water Disposal: Currently, three options for in-valley disposal of drainage water are being evaluated: (1) evaporation ponds, (2) deep-well injection, and (3) discharge to the San Joaquin River. No studies of out-of-valley disposal of drainage water are planned to be conducted by the Drainage Program.

Regulatory and Institutional Changes: Institutional changes may also play a significant role in solving valley agricultural drainage and related problems. Possible institutional changes to promote water conservation, for instance, might include water sales and transfers, tiered (block) water pricing and/or drainage fees, and expansion of local or regional water authorities.

Area-specific alternative plans are being developed for each of 5 subareas within the principal study area. These subareas have been delineated on the basis of hydrologic considerations, political boundaries, current drainage practices, and/or the nature of drainage-related problems.

The Drainage Program is scheduled to be completed in FY 1990. The schedule for key reports and for accomplishment of major activities follows:

Report/Activity	Completion Date
Plan alternatives, first round	End of FY 1988
Data collection and analysis	During FY 1989
Investigative reports	End of FY 1989
Plan alternatives, final round	End of FY 1989
Final plan(s) document	End of FY 1990

Question: Public Law 100-202 directed that funds contained in the Act for the Garrison Diversion Unit be expended only in accordance with Public Law 99-294, Garrison Diversion Unit Reformulation Act of 1986. Is this directive being followed?

Answer: Yes, not only in FY 1988 but also since the Reformulation Act was passed. The 1986 Act, passed on May 12, 1986, directed that construction proceed immediately on the New Rockford Canal, the Oakes Test Area, and municipal, rural, and industrial water systems. Construction then resumed on the New Rockford Canal and Oakes Test Area under contracts which were awarded prior to enactment of the Act. Design activities for completion of the New Rockford Canal and Oakes Test Area were renewed. An agreement for the $200 million MR&I program authorized by the Act was finalized between the State and the Bureau on November 19, 1986. This program involves 25 percent cost sharing by the State. Fiscal years 1987 and 1988 funds have been made available to the State for implementation of that program, mainly on the Southwest Pipeline which was identified in the FY 1986 Act as being eligible for funding. Construction contracts administered by the State are scheduled to be awarded during the spring of 1988 to continue the pipeline project.

The comprehensive studies associated with the James River, as outlined in the Reformulation Act, are continuing. Several State and Federal agencies are working under agreements with the Bureau on these studies. In an effort to reduce project impact, a contract was awarded in November 1986 to assess stabilization requirements for a number of Garrison Diversion Unit operational alternatives.

The 1986 Act also established a Wetland Trust Fund which includes both Federal and State funds to be contributed at specific times in specific amounts. The interest generated by Trust investments will be utilized to restore, enhance, and preserve wetlands in the State of North Dakota. A Wetland Trust Agreement was signed on December 18, 1986, between the Trust and the Bureau, and an amount of $2.5 million in Federal funds was contributed to the fund as required by the Refomulation Act. An additional $500,000 was contributed in FY 1987 and FY 1988 as required by the Reformulation Act.

Davis Creek Dam, North Loup Division

Question: The FY 1989 budget request defers indefinitely the Davis Creek Dam segment of the North Loup Division. Please explain the impact this decision is having on that project office and the ability of the Bureau to complete the North Loup Division as originally planned.

Answer: The Davis Creek Dam segment of the North Loup Division was deferred indefinitely in the 1989 budget because of a policy difference within the administration. OMB had imposed a restriction on the use of 1988 funds for the Davis Creek Dam. That restriction was removed by OMB on April 29, 1988. The Bureau will use these funds for land acquisition and preconstruction activities on Davis Creek Dam. Without FY 1989 funding for the Davis Creek Dam segment, actual construction of the Dam could not proceed and a significant reduction of staff in the project office would be necessary.

Question. What work is planned for the All-American Canal Project (prototype) in fiscal year 1989, and what are the objectives of the project?

Answer. The objective of the project is to test new methods of construction that can eventually be used to line portions of the Coachella and All-American Canals and conserve substantial amounts of water now being lost in the unlined system. Construction of the prototype will be completed in FY 1989. The prototype will be funded with 60 percent non-Federal financing provided by the Metropolitan Water District of Southern California (MWD) and Coachella Valley Water District.

Moreover, the MWD and the Imperial Irrigation District will provide 100 percent non-Federal funding to line the balance of the unlined canals. Approximately 66 miles could be lined if the prototype proves successful.

Finally, if the prototype is successful and the canals are lined using the new method of construction as proposed, the water districts will also repay the Federal funds used to construct the prototype.

Question. It is noted that no funding request has been made for the Atmospheric Water Resources Management Program, which has been included in the Construction Program in FY 1989. What is the impact of this decision on existing or potential cost-sharing agreements and the ability to transfer the technology?

Answer. This program was changed to require direct beneficiary participation and cost sharing by a Reclamation policy announced on October 22, 1986. Subsequently, 9 states and 2 California utilities indicated an intent to begin cost-sharing with Reclamation for transfer of cloud seeding technology in fiscal year 1989. However, no budget request for this purpose was included in the President's budget because of the current budget deficit.

Elimination of funding for the Atmospheric Water Resources Management Program in FY 1989 will require all reimbursible work, including that related to any cost-sharing programs, to be terminated. The staff of the Division of Atmospheric Resources Research has already been reduced by 14 people in response to the FY 1988 budget reductions. Although some important scientist positions were involved in the personnel reduction, the key core personnel have been retained, and the primary technology transfer expertise remains intact. Additional reductions of 8 to 10 positions are anticipated at the end of FY 1988. This will result in a remaining staff of 8 to 10 people to carry on the reimbursible work which is chiefly foreign programs funded by the Agency for International Development.

Question. Has the $18.5 million limitation for all administrative functions had any effect upon your ability to complete the Bonneville Unit by 1995?

Answer. We intend to make every effort to meet the 1995 completion date; however, the limitation on annual noncontract costs during the current period of heavy construction could impact our ability to do so. To comply with the limitation, it has been necessary to reduce staff in the regional and project offices as well as place severe limitations on travel, equipment acquisitions, and other types of costs. In addition, we have revised our design work scheduled at the Engineering and Research Center in Denver to allow only work that is of the highest priority. Should the limitation be extended to FY 1989 or beyond, it would severely reduce the likelihood that we will be able to complete the project on schedule.

The Inspector General, as required by Public Law 99-591, has performed an audit covering FY 1987 expenditures on the Central Utah Project. The April 1988 report verified that the Bureau has taken steps to reduce what it believes are non-contract costs. The audit was to determine Bureau compliance with Congress' FY 1987 directive to limit administrative expenses to not more than 20 percent of total expenses. In the report the IG determined that the Bureau's administrative cost rate in FY 1987 was 8.9 percent. It also found that non-contract costs, which the IG took to be all outlays incurred other than to satisfy the terms of a contract, were $22,901,806 out of total FY 1987 costs of $91,113,056. The IG report pointed out that while the concept of "administrative expenses" is one that is clear under standard Federal accounting usage and Federal procurement regulations, that of "non-contract costs" is not. The IG noted that the Bureau's non-contract activities include such items as project design, environmental and economic assessment, construction supervision, direct Bureau construction, and materials testing. These activities will continue whether by the Bureau or by contract. The report further noted that the contracting out of activities previously performed by the Bureau would not necessarily result in any reduction in administrative costs. The Inspector General suggested that the Bureau needs to work with the Congressional committees to evaluate the "non-contract" limitation to ensure Congressional goals are being met.

Question. Will the Bureau be able to satisfy the legislative mandate of the Groundwater Recharge Demonstration Program funding only 12 of the 21 studies selected for Phase II in FY89?

Answer. We have interpreted the Act as requiring each demonstration project to be 5 years in length, the minimum for collection of technical performance data. Efficient management of staff and resources dictates phasing in the projects. The demonstration projects will be initiated on a staggered-start basis. Each project will run for 5 years; thus, the total program will exceed 5 years.

Operation and Maintenance

Question: The operation and maintenance appropriation for fiscal year 1988 was $151.0 million, and you are now requesting $183.2 million in fiscal year 1989. Please explain the need for this significant increase.

Answer: The increase of $32.2 million is required to finance the first year of a multi-year program to perform critically needed maintenance on a majority of the projects. The need for this program is due to the advancing age of these projects which require renovation and enhancements, and, in some cases, being rebuilt. It is also due to a number of maintenance items having been deferred from previous years due to reductions in the operation and maintenance (O&M) budget request. In the absence of sufficient O&M funding, Reclamation's O&M program has been slipping toward a "catch-up" or breakdown and repair mode with a large and growing backlog of maintenance and replacement work. This program is proposed to be completed in about five years provided adequate funding is approved. In October 1987 the Secretary forwarded to the Congress the Assessment '87 and Implementation Plan in which was stated that the O&M program is one of the highest priorities and will continue to be so in the future. This multi-year program is in accordance with this plan and upon its completion, Reclamation's projects will once again be on a preventive maintenance schedule rather than the breakdown type maintenance that have been experienced during recent years.

Question: Why is the fiscal year 1989 operation and maintenance (O&M) program for the Yuma Area Project increasing?

Answer: The reason this program is increasing is to cover the cost of maintenance items deferred as the result of reduced O&M funding in recent years. These items include O&M activities associated with the river channel, banklines, jetties, training structures, roads, bridges, levees, and floodways from Davis Dam to the Southerly International Boundary. The project also provides O&M for Senator Wash Dam and Pumping Plant, drainage wells and channels in the Yuma area, miscellaneous recreation features, and fish and wildlife features. Additional cost increases are necessary to operate and maintain recently completed features at the Yuma Desalting Plant. Beginning in the summer of 1988 and through 1989, the plant's test train will be operational. The total planned 73-MGD plant is scheduled for completion in 1991 and full operation in 1992.

Question: What steps have been taken to implement the requirements of the Colorado River Floodway Protection Act of 1986? From what source will funding be provided?

Answer: The Charter of the Task Force was filed with the appropriate Committees of Congress on February 3, 1987. The Task Force has held three meetings and a subcommittee is in the process of defining the hydrologic determinations of inflows that will be used to establish the Colorado River floodway boundaries below Davis Dam. Another subcommittee is determining areas where compensation for damages may be appropriate from the 1983 high flows in the Colorado River.

Fiscal Year 1988 funding is being provided by the O&M appropriation for conducting meetings of the Task Force and data collection. We estimate that about $400,000 will be used in FY 1988.

The legislation creating the Task Force directed that certain requirements, including a final report, were to be met by October 8, 1988. However, a variety of logistical problems, in seeking nonimations and the appointment of members to the Task Force, the development of the hydrologic studies and funding have delayed, or could further delay, the work. From all indications, the production of a final report by the Task Force cannot be completed before April 1989.

Question: Please explain how the requested decrease for the Reclamation Reform Act Program is possible given the recent amendments of the RRA?

Answer: The original FY 1989 budget request was for $1,950,000, which is approximately $700,000 less than the FY 1988 amount of $2,650,000. However, the budget submittal did not anticipate the RRA amendments included in the December 22, 1987, Omnibus Budget Reconciliation Act of 1987 (P.L. 100 - 203). Consequently, the Bureau is reassessing its RRA program capabilities to ensure continued performance of an adequate level of compliance activities, including the audit requirements mandated by Congress.

Loan Program

Question. Besides the loans which appear in the fiscal year 1989 budget, are there new loan applications being processed?

Answer. There are 27 loan applications being processed at this time. Attached is a detailed tabulation of this information.

Title	State	Loan Amount $1,000	Application Under Review	Notice of Intent Received	Repayment Contract Status
Ak-Chin West Escalation	AZ	6,511	D		
Central San Joaquin	CA	19,011	D		
Chemehuevi Indian Tribe	AZ	10,000		x	
County of Placer	CA	26,000		x	
East Bench Gravity Sys. No. 3	MT	3,250		x	
Huerfano-Cucharas	CO	2,500		x	
Middle Creek	MT	2,994			Draft
Monterey CFC&WC	CA	26,000	D		
Muddy Creek	UT	15,000		x	
Navajo Nation (Leupp)	AZ	26,250		x	
Navajo Nation (Many Farms)	AZ	18,750		x	
North Cache Irrigation Dist.	ID	26,000	D		
Olivenhain	CA	20,000		x	
Oroville-Tonasket	WA	483		x	
Papago Indian (Chuk Toak)	AZ	5,250	D		
Papago Indian (San Xavier)	AZ	25,500	D		
Petrolia Dam Rehabilition	MT	1,756		x	
Pixley Irrigation District	CA	12,300	D		
Rio Grande Valley MWD	TX	26,000		x	
San Bernardino (San Sevaine)	CA	27,700	F		
San Carlos Irrigation Dist.	AZ	26,250		x	
San Juan Basin Authority	CA	15,000		x	
Sanpete Co. Water Cons. Dist.	UT	26,250		x	
Santa Ana No. 2 (Lower Chino)	CA	27,000		x	
Stockton East Water District	CA	27,671	D		
Thirty Mile Irrigation Co.	NE	10,000		x	
Water Supply and Storage Co.	CO	3,850		x	
Total		437,276			

Question. We note no funding request has been made for the three loans funded by the Congress in FY 1988. What is the Bureau's capability to continue these 1988 loans in FY 1989?

Answer. Should the funds be appropriated, we have the capability to expend about $29 million for these three loans as follows:

Stagecoach Reservoir Project, CO	$ 5,037,000	
United Water Conservation Dist, CA	~~13,586,~~300	-- 11,300,000
San Bernardino County, Day Creek, CA	10,500,000	
Total	$29,123,300	

This discretionary increase for a lower priority activity runs counter to the President's goal of reducing the large federal deficit.

GENERAL INVESTIGATIONS

Question: What work has the Bureau carried out for the National Park Service regarding the Hetch Hetchy Reservoir?

Answer: At the request of the National Park Service, the Bureau completed a report in February 1988 entitled Hetch Hetchy Water and Power Replacement Concepts. That report, which was paid for by the Park Service, outlined a range of possible replacement alternatives, and responded to public comments on a draft of the report which was reviewed by the public. The Bureau concluded that the concepts presented in the report merited further study and recommended that the Park Service pursue the necessary funding for a detailed feasibility study.

Question: What future work will the Bureau be doing?

Answer: Subject to appropriations, at the request of the Park Service, the Bureau would perform a detailed feasibility study which would: (1) organize the study participants to include the entities, agencies, and groups interested in the proposal, (2) establish a public involvement program, (3) develop the scope of work, (4) identify and evaluate replacement options including benefits, impacts, and the cost of restoring Hetch Hetchy Valley to national park uses and determine whether restoration would be viable from an engineering, economic, financial, social and environmental perspective, and (5) prepare a planning report/environmental statement at the conclusion of the detailed study.

Question: Will any of the funds requested for fiscal year 1989 be used for this work?

Answer: Funds requested by the Park Service for fiscal year 1989 will be used for work on the detailed feasibility study.

GENERAL

Question. Please summarize the most recent estimates of annual savings and cost associated with the three elements of the Bureau's reorganization -- Washington Office streamlining; Amarillo Office closing; and consolidating technical planning expertise in the Denver Office. When will the first net savings be realized and how much will they be?

Answer. The annual savings to be achieved starting in FY 1990 will be approximately $7.5 million. Some small amount of saving may be realized in FY 1989 depending on the number of people choosing to be relocated and the speed with which this can be done. The total cost of the reorganization is expected to be $9.6 million: $3.2 million for the Washington Office streamlining, $ .7 million for the Amarillo closing, and $5.7 for the planning consolidation.

Question. Provide for the record a tabulation which shows the Bureau's individual funding capabilities for all studies, planning, operation and maintenance, loans, and construction projects for fiscal year 1989.

Answer. Attached for the record are the Bureau's project capabilities for fiscal year 1989. A discretionary increase for a lower priority activity runs counter to the President's goal of reducing the large Federal deficit.

DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Additional Capability for Projects in the FY 1989 Budget
(dollars in thousands)

Appropriation/Project	Fiscal Year 1989 Request			Capabilities Submitted			Total Capabilities		
	Federal	Non-Fed	Total	Federal	Non-Fed	Total	Federal	Non-Fed	Total
GENERAL INVESTIGATIONS									
Project Investigations									
Delta Water Management	350	350	700	137	137	274	487	487	974
Loup River Basin Study	100	250	350	100	0	100	200	250	450
Southeast Oaklahoma	167	10	177	133	0	133	300	10	310
South Platte-Frenchman Project	248	155	403	100	0	100	348	155	503
Advance Planning									
Umatilla Basin Project	250	140	390	250	0	250	500	140	640
TOTAL, GENERAL INVESTIGATION	1,115	905	2,020	720	137	857	1,835	1,042	2,877
Working Capital Fund									
Working Capital Fund	7,900	0	7,900	3,000	0	3,000	10,900	0	10,900
TOTAL, WORKING CAPITAL FUND	7,900	0	7,900	3,000	0	3,000	10,900	0	10,900
Operation and Maintenance									
Boise Area	2,827	0	2,827	413	0	413	3,240	0	3,240
Central Valley Project	44,959	0	44,959	12,600	0	12,600	57,559	0	57,559
Columbia Basin	23,237	0	23,237	3,350	0	3,350	26,587	0	26,587
Hungry Horse	2,690	0	2,690	1,205	0	1,205	3,895	0	3,895
Land Resource Management	1,900	0	1,900	71	0	71	1,971	0	1,971
Milk River	55	0	55	18	0	18	73	0	73
Minidoka Area	4,864	0	4,864	270	0	270	5,134	0	5,134
Missouri Basin Area, P-SMBP	19,172	0	19,172	1,592	0	1,592	20,764	0	20,764
Parker-Davis	3,551	0	3,551	348	0	348	3,899	0	3,899
Reclamation Law Administration (RRA)	1,950	0	1,950	750	0	750	2,700	0	2,700
Rogue River Basin	247	0	247	145	0	145	392	0	392
Soil and Moisture Conservation	766	0	766	35	0	35	801	0	801
Yakima	3,555	0	3,555	170	0	170	3,725	0	3,725
TOTAL, OPERATION & MAINTENANCE	109,773	0	109,773	20,967	0	20,967	130,740	0	130,740

DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Additional Capability for Projects in the FY 1989 Budget
(dollars in thousands)

Appropriation/Project	Fiscal Year 1989 Request			Capabilities Submitted			Total Capabilities		
	Federal	Non-Fed	Total	Federal	Non-Fed	Total	Federal	Non-Fed	Total
Regular Construction									
Animas-La Plata	1,981	400	2,381	5,811	3,200	9,011	7,792	3,600	11,392
Central Valley Project									
Auburn-Folsom South Unit	1,500	0	1,500	200	0	200	1,700	0	1,700
San Felipe Division	500	0	500	940	0	940	1,440	0	1,440
San Luis Unit, Arroyo Pasajero Activity	27,732	963	28,695	540	660	1,200	28,272	1,623	29,895
Colorado River Basin Salinity Control Project, Title I Division	20,027	0	20,027	3,800	0	3,800	23,827	0	23,827
Columbia Basin Project, Irrigation Facilities	3,930	0	3,930	400	0	400	4,330	0	4,330
Pick-Sloan Missouri Basin Program									
Belle Fourche Unit	4,200	0	4,200	3,400	0	3,400	7,600	0	7,600
Garrision Diversion Unit	26,800	2,500	29,300	19,600	0	19,600	46,400	2,500	48,900
North Loup Division	14,776	700	15,476	10,000	0	10,000	24,776	700	25,476
Recreational and Fish and Wildlife Facilities	17,000	0	17,000	1,882	0	1,882	18,882	0	18,882
Web Rural Water Development Project	11,089	1,000	12,089	1,294	2,656	3,950	12,383	3,656	16,039
Drainage and Minor Construction									
Colorado River Front Work And Levee System	12,071	0	12,071	2,540	0	2,540	14,611	0	14,611
Leadville Mine Drainage Tunnel	200	0	200	835	0	835	1,035	0	1,035
Applied Engineering									
Groundwater Recharge Demonstration Program	3,000	1,553	4,553	3,000	2,093	5,093	6,000	3,646	9,646
TOTAL, CONSTRUCTION PROGRAM	144,806	7,116	151,922	54,242	8,609	62,851	199,048	15,725	214,773
TOTAL, ALL APPROPRIATIONS	263,594	8,021	271,615	78,929	8,746	87,675	342,523	16,767	359,290

QUESTIONS SUBMITTED BY SENATOR BURDICK

Question. After last year's budget disaster, I was encouraged to note your request of $26.8 million for Fiscal Year 1989.

Notwithstanding budgetary limitations, what is your capability for FY89 for Garrison Diversion?

How much for MR&I, which is state administered?

Answer. Notwithstanding budgetary limitations, we have the additional capability for FY 1989 expenditures in the amount of $21.8 million, however this discretionary increase for a lower priority activity runs counter to the President's goal of reducing the large Federal deficit.

Feature	Additional Capability
State MR&I	$14,700,000 1/
Indian Irrigation Preconstruction	1,400,000
Indian MR&I	5,000,000
Recreation	700,000
Total Additional Capability	21,800,000
President's FY 1989 Budget Request	26,800,000
Total Capability	48,600,000

1/ This figure was furnished by Governor Sinner at the Outside Witness Hearings on April 14, 1988.

Question. I recall when we were promised the start of actual irrigation by FY68. We are still waiting. Obviously, the promised fulfillment of your commitment has slipped many times under several Administrations. The people of North Dakota are wondering if you ever really plan to irrigate any substantial acreage in the State, or if it is realistic to expect any of the other promised benefits to materialize.

Based on current and past funding levels, how long before we get water on the land?

Answer. The Reformulation Act defers construction of most supply and irrigation facilities until completion of the James River Study and renegotiation of the master repayment contracts. Also, the Reformulation Act states that, "The Secretary is prohibited from obligating funds for construction of irrigation service facilities...prior to September 30, 1990. Given these constraints and also depending on the availability of funds, it would be about 1996 at the earliest before any substantial water deliveries for irrigation can be achieved, except for about 1,000 acres of the 5,000-acre Oakes Test Area which is scheduled for water service in June 1988.

Question. I note in your justifications you list $31,980,000 as the cost of the Sykeston Canal. Where did you get that number?

What are your estimates of the cost of each of the three routes presently being considered for this canal?

Do you have an estimate, or even a guesstimate, of the cost of routing this canal outside the Hudson's Bay drainage to the extent possible?

Do you think there is any realistic possibility that your preferred routing of the Sykeston Canal will be accepted?

Where are you on the preliminary design of this canal?

As you know, there are very strong misgivings as to the workability of any Sykeston Canal, its costs and other factors. These questions will have to be answered before we proceed to the next phase of the project.

When can you have at least reasonably authoritative preliminary data available? Can this be expedited? Would more money help? If so, how much?

Answer. The figure $31,980,000 was developed from an estimate of $28 million that had been prepared under the direction of the Garrison Diversion Unit (GDU) Commission staff. It was indexed to reflect increase in cost due to inflation. Also, the cost of cultural resource activities, which were not included in the orginal estimate, have been added.

The "Draft Supplement to the Environmental Statement, Commission Plan," DES 86-9, dated March 6, 1986, included discussion of three alternatives. Alternative 1 is the route presented in the GDU Commission Report. Alternative 12 is an alinement which generally follows the Commission recommendation but approximates property boundaries to limit social impacts. Alternative 5 is an alinement which is almost entirely within the previously acquired Lonetree Reservoir boundary. The cost estimates concerning these alinements are:

Alinement	Amount	Date of Estimate
1	48,950,000 1/	January 1987
12	54,190,000 1/	June 1985
5	38,210,000 1/	January 1987

These estimates will be adjusted when further analyses and estimates are completed. We anticipate that such adjustments will be significant.

A preliminary estimate was prepared in June 1987 for an alinement located outside of the Canadian drainage. The alinement considered a canal capacity of 1,000 cubic feet per second and a length of 48.5 miles. There also was a need for a pumping plant and 1.2 miles of discharge line. The total estimated cost was $106,000,000 at October 1986 price levels.

We expect to complete an analysis of the Sykeston Canal near the end of this calendar year. The study will deal with issues such as costs of construction and operation and maintenance; operating requirements; social, environmental and cultural impacts; biota transfer; and risk assessment. The results of that analysis should provide information from which the feasibility of the Sykeston Canal can be determined, and a decision be made on the selection of an alinement.

1/ These cost estimates exclude about $7 million in additional costs for a check structure and a supervisory control system which may be necessary to manage flows without in-line storage and to reduce the risks of biota transfers in the event of a partial failure of the canal.

We have extensive design information with respect to alinement 5. We have only appraisal-grade design information concerning the other alinements. We do not plan to progress further with design development until an alinement is selected.

As indicated by our response above, we expect to complete an analysis by the end of this calendar year which will provide such preliminary data. We do not believe this analysis can be accelerated.

Question. What is the status of the James River study mandated by the Reformulation Act? Everything is contingent upon the completion of that study; can it be expedited at all? Would more funds help? I would hope we could have it well before the deadline.

Answer. Many of the individual studies required for completion of the James River comprehensive study are nearing completion and are in the report preparation stage. A draft of the Comprehensive Report is scheduled for December of this year and the Secretarial report is expected to be complete in July of 1989. We are proceeding as expeditiously as the science allows. We do not believe the study and report process can be accelerated; additional funding would not expedite the process. The circulation for comments of a draft Comprehensive Report by December 1988 will provide Federal-State-private interests with extensive information concerning the findings of the studies.

Question. I am both puzzled and concerned about your request for Fish and Wildlife mitigation and enhancement funding and the report we directed you to file with your FY89 budget.

Our report directed that you report on "funding required to bring mitigation to a level concurrent with project construction by the end of Fiscal Year 1989."

To me, at least, that language is quite clear. Yet, your report and budget request goes beyond that. You propose to develop concurrency to and beyond Fiscal Year 1992 when the development of irrigation areas is scheduled to begin. With all of the uncertainties between now and FY92 built into the Reformulation Act, don't you think you're jumping the gun a bit?

As I see it, at least three thresholds must be crossed between now and that magic date:

-- the James River study must be completed and must be favorable;

-- a master repayment contract must be renegotiated with the Garrison Diversion Conservancy District; and

-- a means of getting water from the McClusky Canal to the New Rockford Canal must be found--either a workable Sykeston Canal or some alternative thereto.

To further complicate things, some of these issues will require further review by the appropriate legislative committees of Congress.

Forget Fiscal Years 1990, 1991, or 1992; what level of funding is necessary to comply with the mandate of the FY88 Continuing Resolution?

Answer The funding identified for years beyond fiscal year 1989 is consistent with the Reformulation Act which requires that mitigation proceed concurrent with project construction. When contracts for construction of GDU supply and irrigation facilities are awarded, the impacts to wildlife occur almost immediately due to the requirement to install drains as well as the dewatering of facilities associated with the construction process. The development of restored wetlands requires the purchase of land, surveys, and the preparation of designs and management plans before physical development and construction of the wetland complex. This typically takes 3 to 4 years before mitigation credits can be achieved, therefore, to meet the requirement of the law, the purchase of mitigation lands must be initiated about 3 years prior to the occurence of project impacts. The outyear impacts are based on the funding levels in the fiscal year 1989 Budget.

If the wildlife impacts, due to construction activities scheduled for fiscal years 1990, 1991, and 1992, were to be disregarded as indicated by the question, the funding requirement for wildlife activities in fiscal year 1989 would be reduced by $2 million, mitigation concurrent with project construction would not be achieved.

Question. One further question: in the table accompanying your report, you list substantial "indirect costs." Please specify what those "indirect costs" include. Also, what are "Misc. Support Activities?"

Answer. The indirect costs shown in the table total $850,000 and consist of the following components:

1. Salaries and benefits of project office personnel who are associated with Fish and Wildlife activities	$526,000
2. Environmental support associated with archeology, NEPA compliance, 404 permits, etc	200,000
3. Regional Office and Project Office administrative costs, including a share of space costs, utilities, supplies, vehicles, etc	80,000
4. Denver Office technical assistance	44,000
TOTAL	$850,000

Miscellaneous Support Activities total $460,000 and include the following:

Aerial Photography, Infrared	$ 65,000
Geographical Information System	150,000
Cultural Resources Contract	40,000
Boundary and Construction Surveys	195,000
Lonetree Reservoir Noxious Weeds	10,000
TOTAL	$460,000

Question. How much are you proposing to carry forward MR&I on Standing Rock and Fort Berthold Reservations?

How much for the development of irrigation for these same reservations?

How will these funds be administered?

Answer. It is anticipated that all funds appropriated for Indian MR&I programs will be expended for that purpose in fiscal year 1988. None of the funds will be used for the development of irrigation for the Standing Rock and Fort Berthold Reservations. We anticipate having a

Memorandum of Understanding whereby funds will be advanced on a quarterly basis from the Bureau of Reclamation to the Bureau of Indian Affairs based on projected expenditures of the tribes. Disbursements to the tribes will then be made by the Bureau of Indian Affairs. Reclamation will provide technical expertise with respect to the work and will approve fund transfers from the Bureau of Indian Affairs to the tribes.

Question. I note you are proposing $1.32 million for recreation facilities. Development of recreation facilities has fallen behind most other aspects of the project. Many opportunities to acquire recreation lands will, I fear, be lost, given the current rate of development. Could you economically utilize an additional amount, say $500,000 to $800,000 for these activities?

Answer. There is the capability of expending the additional sum of $700,000 in fiscal year 1989; however, this discretionary increase for a lower priority activity runs counter to the President's goal of reducing the large Federal deficit, and there are some limitations other than funding which will also affect the progress of the recreation program. On April 13, 1988, the Supreme Court of the State of North Dakota affirmed a district court decision which diminished the capability of the State, as represented by the Garrison Diversion Conservancy District, to provide its required 50 percent matching component for the recreation program. The State had previously conveyed to the United States 62,370 acres of the bed of Devils Lake for a credit of $3,637,750 toward its cost-share component of the recreation and for fish and wildlife enhancement. In accordance with a contract dated February 25, 1971, $2,037,750 of that credit had been allocated to the recreation program credit. Further, it was contemplated that additional higher lands comprising 20,676 acres under and around Devils Lake would be conveyed for substantial additional credits in the future. The Court determined that the State's ownership of the lakebed constitutes an area substantially less than had previously been asserted by the State of North Dakota. The State had claimed its ownership extended to the meander line which was asserted to be the ordinary high-water mark of Devils Lake at statehood. The court ruled that the ordinary high-water mark is ambulatory, following the fluctuating level of Devils Lake. The extent to which cost-share credits and potential future credits will be adjusted as a result of the court's decision has not yet been determined. The State has the option of providing its cost share in cash.

QUESTIONS SUBMITTED BY SENATOR MELCHER

Middle Creek Project

Question. On January 5, 1988, your agency approved a loan application under the Small Reclamation Projects Act for the Middle Creek Project in Montana. The State of Montana has expended over $600,000 to prepare its loan application and is committed to contributing a total of $1,298,975 for this project. The proposed federal share amounts to $3,896,925. Does the Bureau of Reclamation have the capability to provide these funds and administer the loan?

Answer. The President's budget for FY 1989 did not include funding for Middle Creek Project because the loan application had not been approved when the FY 1989 budget was developed. However, the Bureau does have $1,600,000 capability in FY 1989 for work on the Middle Creek Project. This discretionary increase for a lower priority activity runs counter to the President's goal of reducing the large Federal deficit.

Question. The State of Montana submitted its completed loan application for the Middle Creek Project to the Bureau of Reclamation in April 1987, and thereby allowed the Bureau of Reclamation sufficient time to approve that loan in FY 1987. Due to delays within the agency, the loan was not approved until FY 1988, and the interest rate increased from the FY 1987 rate of 7-1/2 percent to the 9-3/8 percent specified for FY 1988. In view of this circumstance, would your agency be able to establish the interest rate for this loan at the FY 1987 rate of 7-1/2 percent?

Answer. The interest rate is not set by the year in which the loan application is approved, but by the signing of the repayment contract. This requirement is set forth in the Small Reclamation Projects Act, Public Law 84-984, as amended. We would not be able to change the rate without Congressional authorization.

Crow Creek Pumping Unit

Question. There is an effort underway in Montana to modify the Crow Creek Pump Plant on the Crow Creek Pumping Unit of the Pick-Sloan/Missouri Basin project. What Is the Bureau's capability to co-fund and complete this project?

Answer. The Bureau's capability for fiscal year 1989 to co-fund and complete this project is $150,000, however this discretionary increase for a lower priority activity runs counter to the President's goal of reducing the large Federal deficit.

SUBCOMMITTEE RECESS

Senator JOHNSTON. The subcommittee will stand in recess subject to the call of the Chair.

[Whereupon, at 3:12 p.m. Wednesday, March 2, the subcommittee was recessed to reconvene at 10 a.m. Tuesday, March 15.]

ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1989

TUESDAY, MARCH 15, 1988

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 10:15 a.m. in room SD–124, Senate Dirksen Office Building, Hon. J. Bennett Johnston (chairman) presiding.

Present: Senators Johnston, Sasser, McClure, Spector, and Domenici.

DEPARTMENT OF ENERGY

ENERGY SUPPLY, RESEARCH AND DEVELOPMENT ACTIVITIES

STATEMENT OF DONNA R. FITZPATRICK, ASSISTANT SECRETARY FOR CONSERVATION AND RENEWABLE ENERGY

SOLAR AND RENEWABLE PROGRAMS

Senator JOHNSTON. Good morning. I apologize for being late. Jimmy Stewart, one and the same, the original, was by my office to lobby this morning. When the movies call, I must attend. [Laughter.]

This morning, we will receive testimony on the fiscal year 1989 budget request for several important research programs and functions of the Department of Energy. We will receive testimony on the Solar and Renewable Energy Program from Assistant Secretary Donna R. Fitzpatrick; and then from the Office of Energy Research with Dr. James F. Decker, Acting Director, will cover High Energy Physics, including the SSC, nuclear physics, basic energy sciences, university research, magnetic fusion energy, biological and environmental research, multiprogram laboratories, and basic research user facilities.

Finally, we will also receive testimony on the Environment, Safety and Health Program of the Department from Garry W. Gibbs, Acting Assistant Secretary for Environment, Safety and Health.

Miss Fitzpatrick, please proceed.

RENEWABLE OVERVIEW

Miss FITZPATRICK. Thank you, Mr. Chairman.

I have a statement for the record, and if I may, I would like to summarize it.

I appreciate the opportunity to appear before the subcommittee today to provide information on our fiscal year 1989 budget request for the Department's renewable energy programs. The budget for these programs is consistent with and supports the goals and objectives of national energy policy, and is fully responsive to the administration and congressional goal of deficit reduction.

SOLAR AND RENEWABLE REQUEST

In support of these strategies, we have requested $123 million for solar and renewable energy R&D. This is an increase of 22 percent over last year's request and 16 percent less than the current year's appropriation.

This budget was developed based upon our multiyear program plans for each of the renewable energy technology programs. The approach we used in these plans is to set a goal for each program and then identify the technical barriers which must be overcome to achieve those goals.

We develop a peer-reviewed plan and include a prioritization of our research needs. In general, the goal is to make each renewable energy technology reliable and economically competitive.

The budget request to implement these plans is not a generous one, but it is within the current federal budget limitations. So, we concentrate our efforts on the highest priority research to address the most critical scientific and technological issues. We believe that this will provide effective programs that will accomplish our program goals.

We also continue to focus on improved dissemination of the results of our R&D programs and on expanding collaboration with the private sector.

The research sponsored by the federal government and private companies is now bearing fruit in better materials and improved components and system designs to increase our energy conversion efficiency and to make alternative energy sources reliable and economically competitive. Now we must look to the future and pursue those activities which will slowly but surely expand and improve our energy supply options.

FUTURE PROGRAM DIRECTION

The way out of our energy problems in the long run must be through better technology to improve both utilization efficiency and supplies of every kind, and the only way to better technology is through research. Here is where there are some crucial decisions to be made and where the Congress and the Department of Energy can work together.

We need to work to assure that every dollar appropriated for R&D is spent productively. If we are going to spend more than the President requests, then let's at least spend it on justifiable peer-reviewed work that actually advances the national interests. If we do that, we can turn the budget reductions that we face into an opportunity to bring more discipline and higher quality work to our research programs.

The days of the add-on programs that nobody really minded are gone because those programs are no longer add-ons, they are substitutions for work that has been peer reviewed and justified in terms of the national interest.

We need to work together to form a consensus because, if we do not, we are going to see our total R&D budget continue to shrink and the truly productive part will shrink even faster.

It is important that the decisions that we make today move the nation toward a greater energy efficiency and broader availability of supply choices. Therefore, Mr. Chairman, we would like to ask you and the subcommittee to review our multiyear plans, which we have recently made available to you, and to give us your comments.

Tell us that we are geniuses or that we are all wet, but most of all we need your help in doing our job better, to support the best and the most productive research for renewable energy.

PREPARED STATEMENT

Mr. Chairman, we appreciate the opportunity to appear before you today and to gain your advice on these matters. I will be happy to answer any questions you may have.

[The statement follows:]

STATEMENT OF DONNA R. FITZPATRICK, ASSISTANT SECRETARY FOR CONSERVATION AND RENEWABLE ENERGY

Mr. Chairman and Members of the Subcommittee, I appreciate the opportunity to appear before you today to provide information on the FY 1989 budget request concerning the Department's Renewable Energy programs. The budget for these programs is consistent with the goals and objectives of national energy policy and is fully responsive to the Administration and Congressional goals of deficit reduction.

I would now like to discuss each of our major program areas under your jurisdiction and its related FY 1988 funding request.

RENEWABLE ENERGY OVERVIEW

The Nation's overall national energy program is built upon broad policy goals -- improving national security, assuring an adequate, stable supply of energy at reasonable costs, and protecting public health and safety and environmental quality. The reliability of an adequate supply of energy impacts day-to-day functions of the entire public and private economy of the nation. Energy is and will remain a vital ingredient in the competitiveness of the country's goods and services in domestic and foreign markets. The nation has made important strides over the past several years towards an improved energy security through increasing the efficiency of energy use and diversifying its sources of energy supplies. Important areas of energy opportunity remain; the ability to build upon these successes will make the critical difference in the Nation's energy, and therefore economic future.

An energy economy that depends largely on imported commodities such as oil or gas can be subject to short term volatility and a large degree of potential uncertainty in response to national or international economic and political forces. But our energy economy is shifting steadily toward reliance on improved technology rather than abundant commodities. Research sponsored by the Department and the private sector will lead to the technologies needed to allow economic access to domestic oil supplies and clean burning of coal.

Improved technology is already allowing us to exploit non-commodity energy supplies by decreasing the costs and increasing the efficiency and reliability of the many types of solar, geothermal, and biomass energy systems. These systems are typically capital intensive; that is, the bulk of the system's life-time cost is for the equipment, not a fuel. The need for large up-front investment can make the systems appear less economically attractive in the short term than a fuel-burning system, but their inherent security and environmental advantages will lead to increased use in the decades to come. Increased reliance on domestically available resources will improve both energy security and economic productivity.

Renewable energy technologies currently make important, often under-recognized, contributions to the Nation's energy supply mix. Renewable energy is about 9% of national energy supplies. This contribution can be expected to reach about 12% of domestic energy production over the next two decades as industry continues to deploy currently competitive technology and begins to exploit the commercial opportunity of technology just now emerging from the R&D process. Similar trends are observed within the international marketplace where renewable energy is playing an increasing role in both industrialized and developing economies.

Today's research will lay a foundation for an even larger role for renewables in the Nation's longer term energy supply system. Renewable energy technologies appear poised to make vital contributions to electric power generation, industrial process heat requirements, solid, liquid, and gaseous fuel needs, and the cooling, lighting, and heating of buildings. Advances in electric energy systems and in energy storage will provide the basis for greatly improved utilization of renewable resources. The DOE research program undertakes research in each of these technology areas.

In order to realize their large potential contribution to the Nation's energy supply, renewable technologies will have to be competitive in the energy market and be compatible with the existing supply system. The Department of Energy's Renewable Energy Program is working toward the goal of producing a technology base upon which the private sector can build to provide the economy with a broader selection of competitive energy supplies. The Federal R&D program serves as a catalyst to stimulate private sector development of renewable technologies.

The current strategy of renewable energy programs is to concentrate Federal resources on scientific and engineering research to achieve a better understanding of the characteristics of renewable energy sources, of the technologies for collecting and converting these sources to useful forms, and of the generic materials sciences to support industrial development of reliable and efficient systems. DOE's research emphasizes basic and applied research and exploratory development that supply the scientific and technical basis for increasing cost-effective use of the renewable energy resource base and important crosscutting technologies for storage of energy and for reliable and efficient management of the electric energy supply network. The focus of such efforts is on those technologies with the greatest long-term promise for contribution to the Nation's energy supply mix. The goal is to advance the technology while avoiding interference with the capacity and responsibility of industry to develop specific commercial products and services.

The Renewable Energy Research Program is structured to ensure maximum responsiveness to the technical innovation requirements of the private sector. Private sector input regarding research direction and emphasis is sought through integration of industry experts in the review and planning of research activities, direct participation of private sector organizations and universities in the Renewable Energy Research Program, and maintenance of an open and active dialogue with industry, trade associations, and universities. Renewable energy technologies can be significantly advanced through research. Many R&D successes have occurred to date, with between two- and ten-fold improvements in technology cost, efficiency, and reliability. Many important scientific and technical obstacles in resource assessment, materials, and systems integration remain, but we are confident that they have been identified and that a sustained research commitment will provide solutions.

A brief review of the funding request for each technology describes the research activities that will advance renewable energy toward its enormous long term potential.

SOLAR BUILDINGS

Recent research has shown that significant increases in the supply of useful solar energy to buildings can be obtained from developments in electrochemistry, holography, optical physics, and advanced materials. For example, switchable glazings, commonly referred to as "smart windows", and advanced phase change thermal storage wallboard materials could double the present solar energy contribution to building heating energy requirements. The FY 1989 Solar Buildings Program budget request of $5.4 million will continue progress in establishing the essential technology base required for industrial development of promising new materials, systems, and related solar building technologies. The goal of the Solar Buildings research program is to increase the energy contribution of solar technologies to the point where 70% to 80% of the total requirement for space heating, hot water, cooling, and lighting of many different types of buildings could be supplied at costs that are competitive with conventional fuels.

The FY 1989 program in solar building materials and components includes continued research on new optical and thermal switching films which control solar gains and thermal losses through building apertures. The switchable film technology has made significant progress towards development of multi-layer electrochromic film assemblies with demonstrated ability to switch reversibly over 100,000 cycles. Work will continue on optimization of the individual film materials. For solar cooling, desiccant materials research has led to prototype dehumidifier systems with substantially improved performance, using microbead silica gels. Several organic materials show promise of dramatic increases in moisture absorptivity and will be experimentally evaluated.

Systems integration research will continue to evaluate the most appropriate systems for applying solar heating, cooling, and daylighting systems in residential and non-residential buildings. An important element of the FY 1989 systems integration research program will be development of analytical tools to enable architects, engineers, and homebuilders to predict the performance of solar building systems using advanced materials. Analysis techniques will be developed for integrating solar technologies with conventional heating and cooling systems. Researchers will also analyze and evaluate the performance and reliability of various solar building technologies when integrated in buildings.

PHOTOVOLTAIC ENERGY

Over the past year, photovoltaics (PV) has continued its steady progress toward emerging as a competitive energy supply alternative. The program has produced increased conversion efficiencies and reliability and reduced costs, all of which have helped U.S. industry establish a leadership position in the competitive world photovoltaics power market, with a broad range of energy products.

In FY 1989 the Photovoltaics Program, with an updated five year research plan and with a budget request of $23.38 million for operating expenses and $0.8 million for capital expenses, will continue the advances resulting from the first research plan covering 1983-1988.

An important step in realizing the potential of photovoltaics as a viable source of energy is the assessment of field performance of installed systems together with maintenance and other requirements. Recognizing this need, the DOE has maintained a seven year program of regular monitoring of experimental systems operating in the field. A recent report on this assessment effort arrives at several significant conclusions. First, the overall consistency of energy production from these systems suggest that performance degradation over time has been minimal; many of the problems in earlier systems have been overcome. Secondly, photovoltaic performance is well understood and can be accurately modeled, thus effectively assuring the quality of new systems designs. Thirdly, to date the typical failure rate of single crystal photovoltaic modules averages well below .5 of 1% per year; efforts are underway to translate these results to today's potentially low cost thin film modules. Finally, and importantly, the current operation and maintenance (O&M) costs for large photovoltaic plants is 0.5 cents per kilowatt hour which compares favorably with current O&M for coal and nuclear. The present conventional single crystal silicon modules are, however, costly and thus emphasis must be placed on advanced materials to obtain higher performance and lower costs and to maintain these attractive reliability and operating results with the new generation PV materials.

U.S. research leads the world in addressing the issues leading to more effective thin films which offer manufacturing cost savings over their single crystal counterparts. In the past year, devices of three different thin film materials have been made with efficiencies greater than 11%, representing the current world record for thin films. Coupled with the higher efficiencies is the development of new, potentially low-cost deposition processes to produce thin films in even larger areas. Thin-film transparent conducting oxides, a product of our research, may also find their way into automobile glass manufacturing. Car windows using this spinoff technology will thus be capable of more rapid and complete defogging and deicing than previously believed possible.

We have also sponsored research that has stretched the boundaries of very high efficiency materials for use in concentrating solar collectors. These materials, with efficiencies of 24%, should lead to the development of multilayered designs called multijunction cells that are capable of collecting more of the sun's spectrum and can potentially attain greater than 30% sunlight-to-energy conversion efficiency.

From our long-term commitment to fundamental research at thirty leading U.S. universities, we have improved our understanding of photo-degradation, developed new materials to replace expensive or highly toxic precursors used in various PV device processes, and developed new processing steps that, when introduced in production lines, will lead to more cost effective photovoltaic energy devices. Based on our research plans, three photovoltaic options could be positioned for industry consideration of production scale-up by the early nineties. These options include various new advanced forms of crystalline silicon, thin films of amorphous silicon or other compounds, and high efficiency materials such as gallium arsenide compounds for use in concentrators.

The success of the photovoltaic program would not be possible without the close collaboration between the U.S. industry and the DOE. We have worked as partners, sometimes under 50/50 cost sharing arrangements, in the steady advancement of this important technology. The FY 1989 program will maintain and build on this partnership to investigate multijunction concepts, large area submodules of thin films, and concentrator concepts and the high efficiency devices that they require. Research will also address the issues of large area scaleability and throughput. Underlying this work will be the fundamental investigations at universities in new electronic materials, low band gap alloys, mechanisms that limit cell performance, and crystal growth. The program will also maintain the unique capability at SERI for precise measurement of material and cell parameters and reliability testing and research. This important technology base research guides researchers throughout the U.S. in understanding and correlating observed physical phenomena. Finally, the wealth of information gathered by the program, together with the special capability available through the Sandia Design Assistance Center, will be used to assist the U.S. photovoltaic industry to build industry leadership domestically and internationally.

SOLAR THERMAL ENERGY

The DOE Solar Thermal Technology Program conducts research on concentrating solar energy systems to meet future electric power and process heat energy needs. The program recognizes not only the importance of advanced research, but also the need for intermediate, high-value technology of more immediate interest to the solar thermal industry. These potential opportunities are in thermal and electric applications, including products for export, hazardous waste destruction, water reclamation, cogeneration, and the production of transportable fuels and high value chemicals.

The DOE Solar Thermal Technology Program is structured both to conduct research on innovative concepts and also to develop reliable, low cost, high performance solar components and systems. Program activities are responsive to user and industry needs.

The results of past solar thermal R&D have supported industry in bringing to the marketplace systems that utilize centrally located engines and first - generation concentrating collectors. Examples of such systems are the Solar Total Energy Project in Georgia, the five LUZ SEGS plants, and the LaJet SOLARPLANT 1. If all existing SEGS utility contracts are fulfilled, it would bring their installed capacity to over 550 MWe and over three and half billion dollars of private investment.

However, because of the projected reduction in electricity capacity additions and low conventional energy prices, it is clear that solar thermal energy utilization will not increase significantly without future reductions in its cost. Thus research is continuing on components that cost less and have improved performance, reliability, and efficiency. The specific objective of proposed research activities is to drive the projected energy cost down from the present 12¢/kWhe to 5-7¢/kWhe for electric power production and to $9/MBtu for process heat applications. Achievement of this capability would make energy from Solar Thermal Technology competitive with many other energy supply options.

The Solar Thermal budget request of $14.7 million operating expenses and $0.3 million capital expenses for FY 1989 supports those activities which address the critical technical uncertainties and performance and cost improvements necessary to achieve the energy cost goals. Those activities include the continued development of innovative membrane heliostats and dish concentrators that have shown dramatic reductions in weight, material requirements, and cost. Research will also be continued on an advanced falling film direct absorption receiver and a sodium reflux receiver that has the potential to significantly improve the efficiency and lower the costs of central receiver and parabolic dish systems. Cost-shared projects with industry to develop highly reliable, mass-producible engines for dish applications will also be pursued. Research on new applications such as solar-enhanced chemical processing and toxic waste destruction will also be continued.

BIOFUELS

Biofuels energy research focuses on the production of liquid fuels, such as alcohols, gasoline, and diesel fuel, and gaseous fuels such as biogas and thermgas. These fuels can be produced from almost any plant material and from certain waste products such as municipal waste. These raw materials, or feedstocks, can be converted into fuels by thermochemical or biochemical processes, or can be combusted to produce steam, heat, or electricity.

Biofuels currently supply 2.8 quads, or approximately 4% of U.S. energy needs, primarily from the combustion of wood. Although this amount of energy is noteworthy, current applications do not exploit the major potential of this unique resource: its ability to produce liquid and gaseous fuels, the energy products this Nation needs most.

The Biofuels and Municipal Waste Technology Program focusses research on selected pathways for biofuel production which are most promising and whose combined realizable energy potential is about 17 quads, or about 20% of current U.S. energy consumption. To achieve this potential, the program addresses fuel pathways that use new or currently available feedstocks for conversion to (1) alcohol fuels, (2) biocrude-derived gasoline, (3) plant oil derived diesel fuel, (4) biogas, and (5) thermgas. These fuel pathways have been incorporated into the program's plan which was developed with input from academia and industry. The renewable liquid and gaseous fuels produced by these pathways provide alternatives to conventional petroleum, natural gas, and other fossil fuels. The FY 1989 budget for Biofuels Energy Systems is $10.48 million operating expenses and $.555 million capital expenses.

Certain aspects of terrestrial crops production research such as increased growth, environmental requirements, and monoculture viability requirements are applicable to all fuel pathways while other research selects and tailors specific feedstock characteristics such as lignin, moisture, and ash content to fit specific fuel pathways. The terrestrial crops technologies include short-rotation intensive culture (SRIC) and herbaceous energy crops (HEC). SRIC research will focus on developing Populus as the lead wood energy candidate. Industry cost-shared monoculture viability projects will continue. HEC research concentrates on selection of species and techniques for conversion to liquid and gaseous fuels. Techniques for development include genetic and biotechnological methods to increase productivity, stress and disease resistance, and energy traits tailored to the specific fuel cycles. HEC research will continue screening species in the Great Plains, Midwest, and Southeast.

Part of the plant oil research focusses on rapeseed, which directly produces plant oil. Laboratory research will use biotechnology to improve the characteristics of the oil as a diesel fuel source. The field research will complete the trials of rapeseed as a winter crop in the Southeast.

The second element of the plant oil fuel pathway, aquatic energy crops research, continues to concentrate on increasing the growth and lipid content of microalgae. Physiological and lipid characterizations of specific strains will be completed and the best performing strains will be selected for advanced productivity and lipid enhancement research. In addition, an outdoor test facility will be operated to evaluate the productivity of selected laboratory developed strains.

Thermochemical conversion research focuses on two fuel pathways; biocrude gasoline and thermgas production from biomass and wastes. The biocrude gasoline research continues to concentrate on producing biocrude oil from woody feedstocks and on upgrading and refining biocrude oils to gasoline. Thermgas research includes steady-state experiments converting high moisture feedstocks to methane gas and continued development of fundamental data such as thermgas clean-up and compression requirements for methyl alcohol production. Research will continue to develop the fundamental data and equations that are essential for the conversion of municipal solid waste to liquid and gaseous fuels. This research includes data for heat transfer and product formation at different pyrolytic conditions. Laboratory research and field tests to develop powdered Refuse Derived Fuels (pRDF) as a direct substitute for oil in existing boilers will continue.

Biochemical conversion research is also focused on two fuel pathways: ethyl alcohol fuels and biogas. The ethyl alcohol fuels research focuses on enzymatic hydrolysis of lignocellulosic feedstocks. Research will be conducted to improve pretreatment methods and evaluate and test advanced enzyme production systems. The biogas research continues to focus on improving anaerobic digestion reaction rates, increasing gas yields, and establishing reactor stability and control. In addition, research efforts will continue using genetic techniques to develop improved anaerobic microorganisms.

In FY 1989, capital equipment funds will be used to maintain the R&D momentum by providing the research centers with state of the art equipment capabilities. Specific equipment requirements include instruments to measure soil, light, and growth conditions, reaction rates, and yields.

WIND ENERGY

The year 1987 saw continued expansion of wind turbine use in the U.S., with an estimated 160 megawatts of capacity added, bringing the installed base to 1460 megawatts. The average size of wind turbines increased in 1987, to slightly over 100 kW. While the rate of capacity growth has slowed since 1985 and fewer commercial firms now exist, a number of the stronger manufacturers and developers are continuing research and development and are beginning to explore overseas markets. Most importantly, the performance and operational availability of machines in the field has continued to improve. Wind turbines in California produced over 1.8 billion KWh of electricity during 1987, which is enough power for 300,000 homes. In addition, the Mod 5B project has been successfully completed. During the 3 month acceptance test period it achieved 106 percent of design performance and an operational availability of 94.7 percent. This is a major achievement during the initial tests of a new and advanced technology machine. In January 1988, the Mod 5B was turned over to the host utility as part of a cooperative agreement to begin utility operational testing and routine power generation.

The objectives of the Department's Wind Energy Program are to improve the understanding of the fundamental physics of wind turbines and to translate this understanding into tools that industry can use to design and develop more reliable, efficient, and cost-competitive wind turbines. The FY 1989 request for Wind Energy is $8.3 million for operating expenses and $0.5 million for capital equipment. These funds will support research in two broad areas: (1) the basic science of wind turbine dynamics that includes atmospheric fluid dynamics, aerodynamics, and structural dynamics, and (2) advanced components and supporting research, in which improved airfoils, variable speed operation, wind/diesel controls, acoustic noise generation and propagation, and systems analysis are studied.

In the area of wind turbine dynamics, FY 1989 efforts will be continued to increase understanding of turbulence, which is a major issue for performance and design loads, and the effects of terrain on general patterns of wind flow and turbulence that strongly affect energy production and structural stresses, particularly in wind farms. Cooperative research and field testing with industry, using existing turbines in commercial windfarms where possible, have proven to be cost effective. Additional testing is planned to ascertain why some turbines have unaccountably experienced extensive structural damage in the windfarm environment. Research evaluations will include wind tunnel and field studies to observe key elements of unsteady flow and performance validation of existing models through cooperative research. A major commitment to structural dynamics experiments is proposed to correlate the wind input to machine stresses through single and multiple instrumentation tower arrays close to an operating turbine. Several blade material fatigue projects will be continued in concert with industry and results will be employed in an experiment involving the combined experience of the national laboratories and industry to provide an extensive data set for subsequent structural analysis.

In the advanced components area, field testing will be continued on improved airfoils for horizontal and vertical axis turbines. This is an area with considerable retrofit potential for existing turbines and has immediate practical applications for industry. Airfoil development efforts will be continued, guided by results from the basic sciences area. Field testing of variable speed control systems through cooperative research is anticipated and research will also be continued to better understand the design and operation of wind/diesel systems.

OCEAN ENERGY

The Ocean Program conducts research and development on ocean thermal energy conversion (OTEC) technology to enable the private sector to make informed assessments of the potential of this technology as a significant energy supply alternative. This is accomplished principally through research on components and systems modelling. The long-range goal of the OTEC program is to achieve sufficient advancement in technology to result in a projected capital cost of $3200/kWe (1984 dollars). The program strategy focuses on reducing the technical uncertainties which would be associated with 5-15 MWe, near-shore, island-based systems, which are judged to be appropriate for the most likely initial OTEC markets. The FY 1989 budget request is $3.1 million for operating expenses.

The installation of a seawater supply system was recently completed at the Natural Energy Laboratory of Hawaii. Cosponsored by DOE and the State of Hawaii, this system draws cold, nutrient rich water from a 2,100-foot depth and supplies both the planned DOE-supported OTEC open cycle 165 kWe experiment and Hawaii-supported mariculture activities. The 40-inch pipe is the largest diameter pipe deployed on the steepest slope known to date.

In FY 1989, the program will concentrate on three areas of research: experimental verification and testing; thermodynamic research and analysis; and materials and structures research. The objective of the experimental verification and testing program is to verify functional feasibility, performance, and operational characteristics of OTEC components, such as heat exchangers and process controls, on a scale that can be extrapolated by industry in designing small plants. During FY 1989, DOE will continue conducting a set of open cycle OTEC component heat and mass transfer experiments leading to integrated tests at the 165kWe level which is considered to be the point from which extrapolations can be made. The installed DOE and State of Hawaii sponsored cold water pipe will be instrumented to determine its response to the ocean environment.

One objective of the thermodynamic research and analysis program is to experimentally determine the effects of trapped gas bubbles and seawater on the open-cycle conversion process. Work will be continued on specifying the performance requirements and initial configuration of the low pressure power converter to be employed in the 165 kW open cycle tests. The program will also experimentally validate selected power system analytical models at a scale sufficient to extrapolate the data beyond the laboratory level. Confidence in these models is important if industry is to design open and hybrid cycle power systems that meet the cost goals of the program. Achievement of these goals is dependent upon increasing the output of the power system and reducing the projected life cycle costs of major components. Materials and structures Research will emphasize the acquisition of data on fouling, corrosion, and erosion of open cycle turbine and heat exchanger materials. This work will be conducted in the ocean environment at the Natural Energy Laboratory of Hawaii.

OTHER SOLAR ACTIVITIES

Support activities for the planned research programs includes international, technology transfer, and resource assessment programs, the function and maintenance of the Solar Energy Research Institute, and program support and direction. The FY 1989 budget request for these activities totals $12.85 million.

An integral part of the renewable energy programs is technology transfer activities, for which we are requesting $1.78 million in FY 1989. Through a variety of activities, such as publications, professional seminars, industry workshops, and the Conservation and Renewable Energy Information and Referral Service, the program disseminates critical information about renewable energy to researchers, industry, and the general public.

The Federal Government is playing a major role in promoting U.S. renewable energy technology in the highly competitive international marketplace through programs sponsored by the interagency Committee on Renewable Energy Commerce and Trade (CORECT). The FY 1989 request for international activities of $.541 million will be used to continue the technical assessment, educational, and industry assistance services of CORECT.

We are requesting $.970 million in FY 1989 for program support activities which provide cross-technology analytical and administrative support to the overall renewable energy research effort. The main objective of the coming year's planning and analysis efforts will be the implementation of multi-year technology development strategies, which will help guide future research activities and enhance their effectiveness.

A reliable solar radiation resource data base is essential to electric supply planners and industrial engineers for designing, siting, and managing efficient, reliable solar power systems. It is equally vital to researchers who require increasingly specific resource data to pursue resolution of the complex scientific issues associated with the solar processes being addressed within the technology research and development programs. We are therefore requesting $.754 million for FY 1989 to continue resource assessment activities that will improve the accuracy of the National Data Base, to obtain reliable current resource measurements to be added to the data base for selected U.S. locations, and to improve the understanding of the temporal resource variability and spectral characteristics.

The Solar Energy Research Institute (SERI) is the primary national laboratory carrying out solar research and development. The $4.64 million request for FY 1989 includes $4.0 million to conduct the final design and initiate construction of the SERI Phase II facility. The 100,000 square foot building will include laboratories with vibration-free floors and toxic materials handling and ventilation capabilities for performing needed solar materials research. The existing laboratory space is housed in leased office buildings that cannot accommodate the program's experimental needs and involve material handling and safety concerns. The $.640 million balance of the request is for improvements to the experimental apparatus (General Plant Equipment) and facilities (General Purpose Projects).

The FY 1989 request of $4.164 million for Program Direction will support staff activities in project management, R&D coordination, technology transfer, and program and general administration duties.

GEOTHERMAL ENERGY

The Geothermal Energy Program carries out research and development, in cooperation with industry, on an array of geothermal resource types (including hydrothermal, geopressured, hot dry rock, and magma) and on energy conversion technologies designed to define the technical and economic boundaries of this vast domestic energy resource. Program activities include applied research, technology development, and technology transfer efforts that will provide the basis for the timely introduction, by the private sector, of new concepts and products into the marketplace. The funding request for FY 1989 for the Geothermal Program is $15.6 million for operating expenses and $0.8 million for capital equipment.

Hydrothermal research will expand the accessible resource base by improving the processes for extraction and injection of geothermal fluids, developing new materials capable of withstanding high temperatures and pressures and corrosive environments, continuing brine chemistry research leading to techniques to prevent plugging of wells and pipes, and developing advanced power cycle technologies to increase power generation efficiencies. Researchers will analyze and synthesize data derived from the very high temperature geothermal reservoir at the Salton Sea Scientific Drilling Project, and data pertaining to the young volcanic area of the Pacific Northwest. In addition, newly developed tracers and interpretation methods will be field tested with industry at Dixie Valley, Nevada, and East Mesa, California. Research will also be carried out on a cost-shared basis under the Geothermal Technology Organization (GTO) with emphasis on high-priority research where results are thought to be attainable in the near term.

The geopressured research program is proceeding to define the technical characteristics and recoverability of the large reservoirs of hot brine and dissolved methane that lie beneath the U.S. Gulf Coast. The FY 1989 program includes experimental well flow testing, tests of the conversion of the brine energy content (thermal and chemical) to electricity in cooperation with industry, and supporting research on the dynamic response of geopressured reservoirs to production conditions. The geopressured research program continues to set records for the cumulative volume of geopressured brine produced and has proven the long-term effectiveness of downhole scale inhibitors.

Hot dry rock research involves the evaluation of the properties of deep crystalline rock and the development of methods to extract geothermal heat from such resources. A new seismic technique for locating fracture planes in crystalline rock was recently developed. Surface equipment will be installed in FY 1989 for the long-term flow test of the large fractured reservoir at Fenton Hill, New Mexico. This will mark the last major milestone in determining the feasibility of current heat extraction methods.

The purpose of the magma energy research program is to develop the technology to locate magma chambers and to extract energy from them. FY 89 research efforts are aimed at determining the depth and size of a large continental magma chamber, evaluate alternative methods of energy conversion, and develop alloys, well cements, and instrumentation capable of performing in the 800 to 1000 degree Celsius magma environment. In FY 1989, the observation well at the Long Valley caldera in California will be drilled.

Hard rock penetration research will improve the technology and reduce the uncertainty of geothermal well drilling, which currently represents about half of the cost of geothermal power. Geothermal wells exceed the cost of typical petroleum wells by factors of two to four, due to the fact that geothermal wells are generally deeper and encounter harder rock, higher temperatures, and more corrosive fluids than do oil and gas wells. Experimental program efforts include research on wellbore diagnostics technology, improved systems for drilling, instruments for detecting fractures in rock formations, and drilling fluid loss control. Tests and experiments will also be carried out on a cost-shared basis under the Geothermal Drilling Organization (GDO).

GEOTHERMAL RESOURCES DEVELOPMENT FUND

The Geothermal Resources Development Fund was established to guaranty private lenders against losses on loans made for the development and use of geothermal energy. Its broader purpose is to develop normal borrower-lender relationships that will provide financing of geothermal projects without Federal risk-sharing. The FY 1989 request is $.075 million in operating expenses which allows for monitoring outstanding loans.

HYDROPOWER

Small-scale hydropower technology is nearing maturity and the DOE program has made significant contributions to the technology base. Therefore, no funds are requested for FY 1989. Ongoing contracted analytical and technical support will be phased out utilizing prior year contracted activities. The remaining technology development and R&D projects then will be monitored by DOE personnel funded within the Geothermal Program Direction request to ensure that technical goals and contractual and reporting requirements are met.

ENERGY STORAGE AND DISTRIBUTION

An increasing reliance upon a broad array of technology-based energy systems will require the development of advanced energy storage and distribution technologies to provide reliable interfaces with the Nation's existing energy distribution infrastructure.

ELECTRIC ENERGY SYSTEMS

Research in the Electric Energy Systems (EES) Program is designed to provide a technology base to enable the future electric energy network to operate more reliably and more economically while protecting health and safety and the Nation's security. The FY 1989 budget for the Electric Energy Systems research is $17.8 million. The request includes some $12.7 million to begin to translate recent superconducting material advances into technology appropriate to power generation and distribution.

The new high temperature superconducting materials have great potential for application on power systems, including generators, motors, transformers, storage, and control and protective devices. Greater system efficiencies, improved system stability, and reduced cost are all possible if the material can be improved to meet the needs for these devices. Presently the material has too low a current density, is too brittle, and is chemically unstable. However, this program is directed at solving these very difficult challenges, and laboratory, industry and academia teams are being formed to make and keep the U.S. competetive worldwide. This research will build on the fundamental knowledge base developed over the past decade, within the electric energy systems program with the previous generation of metallic (helium temperature) superconductors.

Areas of investigation will continue to include determination of the biological health effects due to exposure to high voltage electric and magnetic fields; development of methods and options to ensure appropriate system reliability and the efficient use of resources during expansion of the Nation's future electric networks; development of techniques to provide electric power over a wide range of system conditions including both normal and emergency situations as well as improvements needed for national security;

and development of new materials, advanced controls, and new design concepts to improve the efficiency of electric systems, including high temperature superconductivity. The EES program continues to support research in three program areas: Electric Fields Effects, Reliability R&D, and System Concepts.

In FY 1989 the Electric Field Effects research will continue to determine the impact of combined electric and magnetic fields on living tissue, whole bodies, and abnormal cell growth. Results of research in this area have been transferred through public forums and technical papers and are the basis of important international research. Research results to date include human studies which indicate only temporal whole body impact.

The Reliability R&D activities will continue research on assessment of the high energy impact of an Electromagnetic Pulse (EMP) on the Nation's electric power systems operations and continuing studies on control and operating strategies to mitigate the effects of an EMP. Assessment and modeling of real power systems are virtually complete. Important verification of these models still remain. Methods and strategies to operate complex, very large integrated electric power systems through improved system stability, operational, and restoration techniques (on-line detection and recognition research) will be completed.

Systems Concepts research will continue on conducting polymers for power system applications. Research will be expanded in the high-temperature superconductivity area, developing concepts and practical conductors for application of future devices on electric systems. This research builds on the past low temperature (helium) research of the Electric Energy Systems and Distribution Program as well as the fundamental research conducted by DOE's Office of Energy Research. The research effort will involve research teams from the national laboratories, the private sector, and academia working together on specific issues so that research results can be transferred to the commercial marketplace at the earliest possible time.

ENERGY STORAGE

The Energy Storage program conducts research to provide a technology base to develop advanced storage technologies. The FY 1989 budget for the Energy Storage research is $8.466 million in operating expenses, with $.027 in capital equipment. This request includes $0.75 million for superconducting magnetic storage.

The program has moved toward a more basic and fundamental research agenda which will continue efforts on advanced energy storage systems to improve the efficiency of energy use and enhance the Nation's renewable energy resources. The program will permit international cooperation, thereby providing information exchange on the latest technology developments of advanced energy storage systems world-wide. The energy storage program ranges from fundamental research, to exploratory development of technical concepts, and includes work on new concepts, materials, and components. The variety of technologies includes batteries, fuel cells, and thermal storage. This research provides an alternative for supplying future energy needs extending the useful life of existing utility central generating equipment for increasing the economic attractiveness of renewable energy generating sources and addressing needs for alternate transportation options. As renewable sources of energy become even more competitive, and the penetration into the energy networks increases, the need for energy storage for these intermittent sources becomes more important. These technologies will be used in residential, commercial, industrial, transportation, and utility installations to promote more cost-effective energy use.

In FY 1989 the Electrochemical Storage research activities will continue toward determining the structure, composition, and mode of formation of surface layers on solid and porous electrodes; understanding electrolyte transport; developing new electrochemical couples; and analysis and design of battery and fuel cell components. This will be accomplished with new analytical tools and the study of the relationship between the kinetics of electrode processes and the atomic structure of the electrode surfaces. Other electrochemical research activities will include improving the reliability of the electrolyte for the advanced batteries; continuing performance tests of sodium/sulfur cells designed for electric vehicle applications; and evaluating and developing new sodium/sulfur, zinc/bromine cell designs for electric vehicle and load leveling applications which have improved durability and reliability. Also, research will be initiated to devise innovative concepts for superconducting magnetic energy storage to determine feasibility of smaller capacity, lower cost devices. Electrochemical progress in the past year has included greatly improved solid electrolyte materials, new membranes for fuel cells, and advancement in air electrodes, all of which will contribute to higher levels of reliability and reduced costs.

Thermal and Chemical Storage research will focus on improving the technical and economic viability of seasonal thermal energy storage for commercial and industrial application. Research on hydrogen will continue with higher efficiency electrolysis process improvement.

CONCLUSION

The programs presented for your review today show enormous potential for the future. Collectively, their potential applications are expected to ultimately make them highly attractive candidates for private sector development and deployment. These technologies promise increasing competition within the energy marketplace.

The programs represent a solid commitment to the continuing development of these technologies. We are confident that our proposals will increase understanding of the potential for virtually all of the most promising renewable energy options and will substantially contribute to the base of technical information required for informed decision making by industry and consumers. This is a budget which I believe seriously recognizes today's fiscal responsibilities, as well as tomorrow's anticipated needs.

Thank you for the opportunity to present our budget request.

BIOGRAPHICAL SKETCH

DONNA R. FITZPATRICK

Donna R. Fitzpatrick was sworn in as Assistant Secretary for Conservation and Renewable Energy, U.S. Department of Energy in December 1985. She had served as Acting Assistant Secretary since March 1985, and as the Principal Deputy Assistant Secretary since January 1984.

In this position her responsibilities include management of research and development programs in energy efficiency and alternative fuels for industry, buildings, and vehicles. The programs in renewable energy resources involve research in active and passive solar, photovoltaic, wind, ocean thermal, geothermal, and biomass technologies. In addition, she administers federal grant programs for low-income home weatherization and energy efficiency improvements in schools and hospitals, and coordinates management of three of the five federal power marketing administrations.

In 1983, Miss Fitzpatrick served on a consultant team for the Secretary of Energy to conduct a general review of the Department's conservation and renewable energy programs, focusing on policy, program goals and priorities, budget levels, and new initiatives. In 1980, she served the Office of the President-elect as a member of the Transition Team for the National Science Foundation, reviewing national policy in basic science research, project efficiency, funding, and proposed legislation.

In her law practice, first with the Washington, D.C., firm of O'Connor and Hannan and then as a sole practitioner, Miss Fitzpatrick worked extensively on real estate development, property and tax law, business organization, and civil litigation, including administrative law and contracting issues.

Miss Fitzpatrick received a Bachelor's degree in physics cum laude from the American University in 1972. After teaching high school chemistry and mathematics, she entered law school and graduated from the National Law Center of George Washington University in 1980.

January 1987

SUPERCONDUCTING SUPER COLLIDER

Senator JOHNSTON. Thank you very much, Miss Fitzpatrick.

Senator Sasser, I understand, has to go to another committee and would like to make a statement or do some questioning at this point.

Senator SASSER. Thank you very much, Mr. Chairman.

As you know, we have four appropriations subcommittees meeting simultaneously this morning. Also, we have a markup going on in the Governmental Affairs Committee.

I would like to take this opportunity, just briefly, to commend the Department of Energy on its initiative in developing the proposal for the Superconducting-Super Collider project.

The Super Collider would be capable of exploring new areas of high-energy physics and could open the door to important discoveries in a wide variety of fields at a time when our country is striving hard to maintain or recover an edge of competitiveness, whatever your viewpoint might be. It represents a sort of basic scientific research that is essential to maintain our nation's economic and technological competitiveness.

I support the Super Collider concept, Mr. Chairman, but I am realistic about the chances of appropriating $363 million that the Department of Energy has requested to get this project off the ground. I know that you, Mr. Chairman, have expressed your concern about the Department's request and the ability of this subcommittee to find that much money in our budget this year.

We need, therefore, I think, to explore ways to finance the construction of this important project that take into consideration the realities of the current budget climate that we find ourselves operating in. I encourage the Department to help in this effort. I pledge to work with members of this committee and the administration to make the Super Collider a reality.

GAS TURBINE TECHNOLOGY

One important matter, we included last year report language directing the Department to use $1 million to help in the development of gas turbine burning wood technology. This gas turbine would be fired by an external compressor or energy source consuming wood. I think that this is a project which has substantial potential, and I want to urge the Department to move with all due haste in getting this project underway.

Thank you, Mr. Chairman.

Senator JOHNSTON. Thank you, Senator Sasser.

OFFICE OF ENERGY RESEARCH

STATEMENT OF DR. JAMES F. DECKER, ACTING DIRECTOR, OFFICE OF ENERGY RESEARCH

Senator JOHNSTON. Next we will hear from Dr. James F. Decker, the Acting Director of the Office of Energy Research.

Dr. Decker.

Dr. DECKER. Thank you, Mr. Chairman.

I am pleased to have the opportunity today to discuss the fiscal year 1989 budget request for the Office of Energy Research. I have submitted a written statement for the record, and with your permission I will proceed to summarize such statement.

This budget supports long-range, fundamental, and applied research that provides new knowledge and the scientific base necessary for the development of energy and other technologies.

BUDGET REQUEST

The fiscal year 1989 budget request is approximately $2.4 billion for Office of Energy Research programs and is a major component of the Department's research and development commitment.

One of the unique contributions of the energy research program to the nation's R&D enterprise is its support of major experimental facilities at the leading edge of technology. These facilities, located in our laboratories, are available for use by scientists from national laboratories, universities, and private industry.

These user facilities include accelerators, synchrotron light sources, research reactors and other large facilities too costly for individual research facilities or industrial laboratories to afford. Our fiscal year 1989 budget request includes funding both to preserve the core capabilities of our research programs and to operate our user facilities.

A few selected enhancements that I will discuss in a minute are provided in our request to take advantage of new research opportunities and to make new state-of-the-art facilities available to the U.S. scientific community.

A side benefit from our research program is that students are trained at our major facilities and through direct support of research and development at universities throughout the country.

I will now provide some brief highlights of the budget request.

MAGNETIC FUSION PROGRAM

First, on magnetic fusion energy. The Department's Magnetic Fusion Energy Program is focused primarily on the physics of fusion plasmas. The program's major experiment is the Tokamak Fusion Test Reactor at Princeton.

We are continuing preparation for the deuterium-tritium break-even experiments in TFTR. Equipment installation will be finished during fiscal years 1989 and early 1990. System checkout will take place in the second half of 1990. Actual deuterium-tritium experiments will begin in January 1991.

At the same time, we are studying plasma confinement in TFTR with deuterium plasmas at increasing power levels. This year, for the first time, TFTR plasma conditions exceeded the original design goals, giving us confidence that the deuterium-tritium experiments will be very productive.

To move beyond the break-even conditions in TFTR, our fiscal year 1989 request includes construction of a Compact Ignition Tokamak, using the TFTR facilities and staff, that would attain ignition conditions in which fusion reactions are self-sustained. This is a critical remaining science question in the development of fusion energy.

Senator JOHNSTON. Did you say that it is a question?

Dr. DECKER. Yes, sir.

Senator JOHNSTON. You don't know if you can do it, or is it just a frontier that you have to pass?

Dr. DECKER. In terms of attaining break-even conditions, we are quite confident from the results that we will come very close to break-even conditions. There are always some uncertainties in this business, but with the modifications that we are making, our predictions are that it will be between a half to one-and-a-half of energy break-even.

Senator JOHNSTON. I guess I am quibbling over the words. There is no doubt that, given enough money and time, you can reach the break-even point in the fusion research program.

Dr. DECKER. That is correct.

Senator JOHNSTON. OK.

HIGH ENERGY PHYSICS

Dr. DECKER. Next, I want to talk a little bit about High Energy Physics. This is a most fundamental area of basic research for which the Department has the primary responsibility.

Our fiscal year 1989 request emphasizes exploiting the enhanced capabilities of collider facilities at FermiLab and SLAC. We will also continue construction of large detectors—D-Zero at Tevatron and SLD at SLAC—to keep these accelerators in the forefront of research during the early 1990's.

SUPERCONDUCTING SUPER COLLIDER

Most important for the future of high-energy physics is the Superconducting-Supercollider [SSC]. Our request increases the research and development program for this project from $25 million to $64 million. We are also requesting $283 million to begin construction in fiscal year 1989. Specifically, we are asking funds for detailed design of technical systems and conventional facilities, long-lead critical path procurements and site preparations.

In order to share the cost of this world class facility, the Department is aggressively seeking international participation on SSC, either through cost sharing or with in-kind contributions. I believe substantial in-kind contributions are likely from several countries, but significant foreign commitments are not expected until Congress appropriates significant support for the project.

NUCLEAR PHYSICS

In nuclear physics, we are requesting funds to continue construction of the Continuous Electron Beam Accelerator Facility, with completion of the project expected in 1993. We are also requesting funding to continue nuclear physics research at existing facilities and to continue research and development on a possible new accelerator at Brookhaven.

The next budget that I would like to discuss is that for basic energy sciences [BES].

BASIC ENERGY SCIENCES

This is a broad area of research that underlies many of the Department's more applied programs. Basic energy sciences operates a number of user facilities such as synchrotron light sources, very high resolution microscopes, and research reactors.

An example of BES-supported research that is quite highly publicized at this time is in the area of high temperature superconductors. Our request includes funding to continue research on these most interesting materials. High temperature superconductors provide a good example of how basic energy sciences research and user facilities can be mobilized to exploit new discoveries.

The atomic structure of these materials has been determined using neutrons from our research reactors and photons from our synchrotron light sources. Important information on the microstructure of these materials has been obtained using the Department's electron microscopes.

In the area of new facilities, our request includes funding to begin construction of the 7 GeV synchrotron light source at the Argonne National Laboratory. The higher energy, higher intensity x-rays to be uniquely available from this source will open up new research opportunities and materials, biology chemistry, medicine, and other fields.

The last program that I would like to mention is biological and environmental research.

HUMAN GENOME PROGRAM

Our request will expand the Genome Program that has, as its ultimate goal, the complete characterization of the human genome at the molecular level. The Department is cooperating with the National Institute of Health in carrying out this project.

Senator JOHNSTON. What is the total cost of that project seen through to its finish, and how long will it take?

Dr. DECKER. That is a question that is a little bit hard to answer. Some of the estimates that have appeared publicly are very large. They have been on the order of $3 billion, but that is based on today's technology.

The thrust of our program is to develop new technologies, which we believe can be done, to greatly reduce the cost of doing that kind of project. We see technologies coming along now that probably within a couple of years could reduce the cost by maybe a factor of five or so. Hopefully, we can improve on that.

Senator JOHNSTON. Computer technology?

Dr. DECKER. Some of it is computer technology, also in new sequencing technology.

Senator JOHNSTON. How long will this take?

Dr. DECKER. I would see a technology development program lasting probably on the order of 5 years or so. I don't think one would launch on the much larger project of trying to sequence the human genome until after those new technologies are developed.

As I started to say, the Department's unique role would be to develop technologies and other resources needed to map and ultimately sequence the human genome.

The value of this program, and DOE's approach to it, has recently been endorsed by recommendations of the National Academy of Sciences.

Our request also includes funding to expand research into the health effects of radon and to expand research in subsurface microbiology. In regard to the latter, the discovery of varieties of bacteria deep in the soil offers a possibility of neutralizing harmful chemicals that have found their way underground before they can migrate and cause undesirable effects.

PREPARED STATEMENT

Mr. Chairman, that concludes my remarks. I will be glad to answer any questions.

[The statement follows:]

Statement of James F. Decker, Acting Director, Office of Energy Research

Mr. Chairman and Members of the Subcommittee:

It is a pleasure to appear here today to present the FY 1989 budget request for the programs supported by the Office of Energy Research (ER). These programs are: High Energy Physics, Nuclear Physics, Basic Energy Sciences, Magnetic Fusion Energy, Biological and Environmental Research, Energy Research Analysis, University Research Support, University Research Instrumentation, and Multiprogram Energy Laboratories-Facilities Support and supporting program direction. Funding for these programs in FY 1989 is being requested under the three separate appropriations shown in Table 1.

The new Basic Research User Facilities (BRUF) appropriation includes funding for construction, operation, and maintenance of the Office of Energy Research's major "user facilities." Construction and operation of these large, complex and expensive facilities requires sustained, central federal support since they are far too large and costly to expect non-federal research institutions to provide such facilities for the benefit of the scientific community. These facilities provide a unique national resource for forefront research in areas related to the use and production of energy. Their continued operation is essential to ensure a continuous support of new knowledge, trained personnel and new directions for the energy well-being of the U.S. and to support the technology base that is vital to the Nation's

Table 1
Energy Research Programs by Appropriation
FY 1989

Energy Supply R&D	General Science and Research	Basic Research User Facilities (BRUF)
Basic Energy Sciences	High Energy Physics	BRUF-High Energy Physics
Magnetic Fusion Energy	Nuclear Physics	BRUF-Nuclear Physics
Biological & Environmental Research	General Science Program Direction	BRUF-Superconducting Super Collider
University Research Support		BRUF-Basic Energy Sciences
University Research Instrumentation		
Energy Research Analysis		
Advisory & Oversight Program Direction		
Policy and Management		
Multiprogram Energy Laboratories-Facilities Support		

economic future. It is important to note that the BRUF funds, which include operating expenses, capital equipment and construction, provide only for the construction, operation and maintenance of the facilities. The research conducted in these facilities continues to be funded under the Energy Supply R&D or General Science and Research appropriations.

The FY 1989 budget request for ER's programs is shown in Table 2. The total amount requested in FY 1989 is $2.4 billion, an increase of $0.3 billion over the FY 1988 appropriation of $2.1 billion.

HIGH ENERGY PHYSICS

The main goal of high energy physics research is to develop new knowledge and a better understanding of the nature of matter and energy as well as the basic forces that govern all processes in nature. One of the major current objectives of high energy physics research is to develop a unified description, or single theory, that would describe all the interactions of matter and energy in the universe. Another major objective is to search for the most fundamental constituents of matter. As with any exploratory field of research, one can also anticipate new and totally unexpected discoveries.

In recent years, high energy physicists have developed an increasingly better understanding of the forces of nature and the unifying connections among them. The four known fundamental forces are the electromagnetic force, the weak force, the strong force, and the gravitational force. The search for a unified, or single, theory has been a reliable guide to physics research. It is a search for linkages between apparently diverse phenomena in an effort to discover underlying simplicity. A part of the progress in high energy physics has been the conceptual unification of the weak nuclear force and electromagnetic forces into a single "electroweak" framework. In addition, a theory of the strong force has emerged which is consistent with experimental results. There is increasing anticipation that the unification of the strong nuclear and the electroweak forces into one "grand unified" framework may be possible, thus reducing the apparent number of forces in nature to two. The

Table 2
Office of Energy Research
Summary by Program
Budget Authority
($ in millions)

	FY 1987	FY 1988	FY 1989 Request
Energy Supply R&D			
Basic Energy Sciences	$432.3	$437.2	$375.6
Magnetic Fusion Energy	341.6	335.0	360.0
Biological & Environmental Research	191.1	269.3	249.0
University Research Support	15.6	18.4	15.8
University Research Instrumentation	4.9	5.0	5.0
Energy Research Analysis	2.0	3.7	3.8
Advisory & Oversight Program Direction	2.5	3.2	3.3
Policy and Management	0.6	0.7	0.7
Multiprogram Energy Laboratories-Facilities Support	56.7	53.6	65.9
Subtotal	$1,047.3	$1,126.1	$1,079.1
General Science & Research			
High Energy Physics	$201.9	$217.4	$220.4
Nuclear Physics	122.2	134.9	141.4
General Science Program Direction	2.5	2.8	3.2
Subtotal	$326.6	$355.1	$365.0
Basic Research User Facilities			
Basic Energy Sciences	$ 87.2	$125.5	$140.5
Nuclear Physics	92.7	110.2	122.7
High Energy Physics	273.4	314.2	346.4
Superconducting Super Collider	20.0	25.0	363.0
Subtotal	$473.3	$574.9	$972.6
Total ER	$1,847.2	$2,056.1	$2,416.7

ultimate goal is a "super-grand" unification that would bring all of the forces in nature into a single unified framework.

This picture of nature in terms of the electroweak and strong forces and a small set of fundamental constituents is known as the Standard Model. The most significant recent experimental results all reinforce the predictions of the Standard Model. Although no deviations from the Standard Model have been found, scientists believe that it cannot be the final answer. For example, it does not explain the origin of mass and it does not include gravity. Experiments using newly available research capabilities at Fermi National Accelerator Laboratory (Fermilab) and the Stanford Linear Accelerator Center (SLAC) are testing the Standard Model and searching for phenomena that do not conform to that Model, as well as for phenomena predicted by newer theories.

The ability to carry out forefront exploratory research on the physics frontier is critically dependent on the experimental capabilities of the accelerators, colliding beam devices and large particle detectors. Provision of upgraded and new facilities on a timely basis, thus, is an important consideration. There are three DOE supported accelerator centers, Fermilab, Brookhaven National Laboratory (BNL), and SLAC, each of which provides world-unique capabilities. Two major upgrades of U.S. High Energy Physics facilities, the Stanford Linear Collider (SLC) and the Fermilab Tevatron Collider, which recently came into operation, will be available to produce strong research output in FY 1989. These facilities will keep the Program highly competitive and at the cutting edge for the next several years. To maintain an internationally competitive program at the scientific frontier in the mid 1990's, activities leading to the construction of a new major facility, the Superconducting Super Collider (SSC), have been initiated.

University scientists carry out over three fourths of the experimental and theoretical research in the field, much of it at the major accelerator facilities. Universities not only provide intellectual leadership for the field, but also play a major role in the training of highly skilled scientists and engineers. In fact, many of these experts are eagerly sought by industry and other scientific disciplines. As they apply their high energy physics training in other areas, these scientists contribute significantly to the transfer of technology to other fields. For example, the 1979 Nobel Prize in Medicine was shared by Alan Cormack who applied techniques from his experience in bubble chamber data analysis in the High Energy Physics program to develop the computerized axial tomography technique for medical diagnosis. This technology, commonly known as the CAT scan, is in widespread use today. Before turning to a discussion of the FY 1989 budget request, I would like to summarize some of the progress made in 1987 at the major High Energy Physics research facilities. At the Tevatron at Fermilab, the new capabilities for proton-antiproton colliding beam experiments achieved record high values of beam energy and intensity, with both beams operating at 900 billion electron volts (GeV) for colliding beam experiments. The antiproton source set a new world record by repeatedly accumulating more than 10 billion antiprotons per hour. Progress also continued on the two major colliding beam detector facilities that will measure the results of collisions at the Tevatron's new energy levels. During its initial physics run at Fermilab, the Collider Detector (CDF) fully met all its technical goals. Besides completing its first checkout and engineering run, CDF physicists were able to record more than 400,000 triggered events on about 500 magnetic tapes--enough data to ensure new insight into the unexplored terrain of antiproton-proton interactions at the 1.8 trillion electron volts (TeV) reaction energy. In addition, fabrication of the massive, 5,500 ton D-Zero detector for the Tevatron collider advanced well in 1987 and remains on schedule for full operations in 1990 when it will take data simultaneously with the CDF and, thereby, double the Tevatron's collider physics productivity.

The just-completed Tevatron fixed target program run has been the most productive one since the superconducting accelerator was first brought into operation in 1983. In just over 30 weeks of operation at its world record beam energy of 800 GeV for fixed target experiments, the Tevatron has accelerated almost two billion billion (2 x 10^{18}) protons. Eleven major fixed target experiments, involving about a thousand physicists and graduate students, have been completed. Almost a hundred Ph.D. theses at several dozen major universities are anticipated based on analyses of the data collected during these experiments. Four new fixed target beam lines were commissioned and brought into operation for data collection during this period. In addition, essential calibration tests of apparatus and R&D efforts were successfully carried out in two test beams which operated parasitically during the fixed target physics run. Extensive studies and commissioning work were also carried out using the Fermilab Antiproton Accumulator ring in a new mode of operation in which it can provide a beam of antiprotons for a fixed target experiment when not needed for the collider physics program. In summary, we have just concluded the most productive and successful fixed target operating period ever conducted at Fermilab.

In 1987, the Stanford Linear Accelerator Center's ability to study collisions of electrons with positively charged particles (positrons) significantly increased with the completion of the Stanford Linear Collider (SLC) project. Beam testing and tune-up are in progress now. Initial operation for research, at a reaction energy of 94 GeV, is expected to begin very soon. The higher energies available in the SLC will enable scientists to conduct important new experiments, particularly with regard to the electroweak force. In preparation for first collisions of 47 GeV electrons and positrons, the upgraded Mark II Detector was installed in the SLC interaction region and tested with cosmic rays during 1987. It is now ready to capture results of collisions in the SLC's unprecedented electron-positron energy range. Substantial progress was made in the fabrication of the Stanford Large Detector (SLD) during 1987. The SLD is a full-scale detector, designed specifically to optimize the physics output from the electron-positron collisions in the SLC.

At Brookhaven National Laboratory the major technical design and the conventional construction design efforts for the Alternating Gradient Synchrotron (AGS) Accumulator/Booster were completed and the tooling and initial procurements for the 202-meter ring of beam-bending magnets began. This additional particle injector to the AGS will increase the intensity of both the AGS proton beams by 400 percent and the intensity of polarized proton beams by 2000 percent. This enhancement will permit researchers at Brookhaven to explore previously inaccessible areas of the subatomic world and will significantly increase the rate of data collection.

FY 1989 HIGH ENERGY PHYSICS BUDGET REQUEST

The FY 1989 request for the research portion of High Energy Physics is $220.4 million. Of the total amount, $144.9 million is for Operating Expenses, $66.1 million is for Capital Equipment and $9.4 million is for Construction (Tables 3 & 4). This request falls under the General Science and Research appropriation. I will discuss the Basic Research User Facilities request for High Energy Physics and for the Superconducting Super Collider after I describe the budget request for our High Energy Physics research program.

The Operating Expenses request supports university and laboratory research groups who carry out experimental and theoretical research in high energy physics as well as detector R&D studies to develop new and advanced concepts and technologies. FY 1988 will be a year of strong research output from the new Tevatron and SLC colliders and new Tevatron fixed target capabilities. Research activity planned for FY 1989 is expected to be very productive as the data collected in FY 1988 are analyzed and these new facilities operate in an intensive data-taking mode.

The FY 1989 High Energy Physics Capital Equipment request of $66.1 million will provide the particle detection apparatus and data analysis systems essential to forefront high energy physics research. In FY 1989, priority will be given to continued progress on the fabrication of the SLAC Large Detector for the Stanford Linear Collider and the D-Zero Detector for the Tevatron collider. With this continued progress, first physics research with these detectors is planned to be started early in FY 1990 and the detectors can be completed by the end of FY 1990.

Table 3
General Science and Research
High Energy Physics
Budget Authority
($ in millions)

	FY 1987	FY 1988	FY 1989 Request
Operating Expenses			
Physics Research	$109.0	$116.7	$123.8
High Energy Technology	21.4	20.3	21.1
Subtotal	$130.4	$137.0	$144.9
Capital Equipment	59.0	63.8	66.1
Construction	12.5	16.6	9.4
Total High Energy Physics	$201.9	$217.4	$220.4

Table 4
General Science and Research
High Energy Physics
Budget Authority
($ in millions)

Construction

Project	TEC	FY 1988	FY 1989 Request
Central Computing Facility (86-R-104)	$24.1	$ 11.0	$ 3.6
General Plant Projects (GP-E-103)	5.8		5.8
General Plant Projects (GP-E-103)	5.6	5.6	-
Total Construction		$ 16.6	$ 9.4

The FY 1989 Construction request is $9.4 million. This request includes final funding for the central computing upgrade at Fermilab ($3.6 million) which is scheduled to be completed in 1989. This upgraded computing capability is required to analyze the large volume of new physics data coming from the Tevatron program. This request also provides $5.8 million for General Plant Projects at Brookhaven National Laboratory which are required to keep the general plant (e.g., buildings, roads and utilities) in good operating condition.

BASIC RESEARCH USER FACILITIES--HIGH ENERGY PHYSICS (BRUF-HEP)

The ability to carry out forefront exploratory research in high energy physics is critically dependent on the effective operation of the major accelerator and collider facilities. The new BRUF appropriation provides funds to build, operate, and maintain these facilities. The total BRUF-HEP request for FY 1989 is $346.4 million. Of that total amount, $301.7 million is for Operating Expenses. The Capital Equipment request is for $13.7 million; and the Construction request is $31.0 million (Tables 5 & 6).

Within the Operating Expenses request, the highest priority will be given to operating the new world forefront research capabilities of the Stanford Linear Collider and the Tevatron proton-antiproton collider and fixed target programs. Operation at SLAC of the upgraded Positron-Electron Project collider with the improved Time Projection Chamber detector and operation at BNL of the Alternating Gradient Synchrotron program on rare kaon decay will also be very important. Accelerator R&D, including studies of advanced accelerator concepts, will be supported at about the same level of effort as in FY 1988.

The Capital Equipment request of $13.7 million is needed to maintain and enhance the scientific capability of the accelerators and colliders and to provide the secondary beam line components and portable shielding needed to do

Table 5
Basic Research User Facilities (BRUF)
High Energy Physics
Budget Authority
($ in millions)

	FY 1987	FY 1988	FY 1989 Request
Operating Expenses			
Facility Operations	$204.3	$233.3	$256.6
High Energy Technology	39.1	43.4	45.1
Subtotal	$243.4	$276.7	$301.7
Capital Equipment	$ 11.1	12.9	13.7
Construction	18.9	24.6	31.0
Total BRUF-HEP	$273.4	$314.2	$346.4

Table 6
Basic Research User Facilities (BRUF)
High Energy Physics
Budget Authority
($ in millions)

Construction

Project	TEC	Prior Year	FY 1988	FY 1989 Request
Accelerator Improvements and Modifications (89-R-301)	$11.7	-	$ -	$ 11.7
Accelerator Improvements and Modifications (88-R-101)	11.2	-	11.2	-
General Plant Projects (GP-E-302)	5.3	-	-	5.3
General Plant Projects (GP-E-103)	5.1	-	5.1	-
AGS Accumulator/Booster (86-R-105)	31.7	$4.4	8.3	$ 14.0
Total Construction		$4.4	$ 24.6	$ 31.0

high quality high energy physics experiments. Funding in FY 1989 will provide for support of planned accelerator maintenance, upgrading and modifications at Fermilab, SLAC and BNL.

Of the $31.0 million Construction request, $14.0 million will provide for continued construction of the AGS Accumulator/Booster at BNL. This project, which is scheduled for completion in FY 1991, will improve the performance and capabilities of the AGS and will significantly increase the data collection rate for the experimental program already planned and underway. The Construction request also includes funds for a constant level of effort for Accelerator Improvements and Modifications Projects ($11.7 million) that are required to maintain the scientific effectiveness and the operating reliability and efficiency of the accelerator and colliding beam facilities. Finally, the request provides $5.3 million for a constant level of effort for General Plant Projects at Fermilab and SLAC that are required to keep the general plant of the laboratories (e.g., buildings, roads and utilities) in good operating condition.

BASIC RESEARCH USER FACILITIES--SUPERCONDUCTING SUPER COLLIDER (BRUF-SSC)

As I noted earlier, experimental research in high energy physics requires the use of large particle accelerators, colliding beam devices and detectors. To extend the research frontier into a region never before studied and where major breakthroughs in understanding are firmly anticipated, larger, more powerful accelerators are required. Major upgrades of the Stanford Linear Collider at SLAC and the Tevatron Collider at Fermilab will keep the U.S. High Energy Physics program internationally competitive and at the cutting edge of physics research for the next several years. But even these facilities will not reach high enough energies to allow physicists to investigate the region where major breakthroughs are anticipated. There are many important unanswered questions such as whether there are even more fundamental particles than quarks and leptons, what determines their basic properties and whether there are new, undiscovered forces of nature. To advance the research frontier, a new, more powerful accelerator is needed. The proposed Superconducting Super Collider is that facility.

Table 7
Basic Research User Facilities
Superconducting Super Collider (SSC)
Budget Authority
($ in millions)

	FY 1987	FY 1988	FY 1989 Request
Operating Expenses	$ 20.0	$ 25.0	$ 64.0
Capital Equipment	-	-	16.0
Construction	-	-	283.0
Total SSC	$ 20.0	$ 25.0	$363.0

As Secretary Herrington has noted, this Presidential initiative is a watershed for America's scientific and technological leadership and another clear sign that this Administration is committed to keeping this Nation on the cutting edge of world leadership and competitiveness.

The SSC is essential if we are to maintain leadership in high energy physics research into the 21st century. In the past, U.S. leadership has been maintained by successive commitments to more powerful, sophisticated accelerators. The SSC represents the next generation of advanced accelerators. It will be built using existing, state-of-the-art technology and will require the best minds in engineering and computer sciences for its construction and operation. The technology developed in building the SSC is expected to lead to industrial innovation in such areas as computing and electronics. In this age of keen international competition, the SSC is vital to the United States' capability to maintain its leadership in the laboratory and the marketplace.

Another important benefit of the SSC is that it will be a valuable training ground for American scientists and will attract many of the world's leading physicists to live and work in the United States. The SSC would be utilized by over 100 American university-based research teams, thereby continuing the precedent of accelerator facilities as a career launching pad for young scientists and engineers. The SSC would be a viable inspiration for young people to pursue careers in advanced science and technology by challenging a new generation to unlock the secrets of nature.

The FY 1989 request includes $363.0 million for the Superconducting Super Collider (Table 7). The heart of the SSC will be two rings containing about 10,000 superconducting magnets located in a racetrack-shaped tunnel about 53 miles in circumference and 10 feet in diameter. There will be four interaction regions at which experiments will be carried out with detectors that record the results of the collisions between beams of protons, each having energy levels of 20 TeV. The SSC will be a powerful basic research tool that will significantly extend the frontiers of understanding of the basic nature of matter and energy. We also expect that the SSC will produce significant research results and technological spinoffs. The Department is proceeding on course with its plan to select the site for the SSC in January 1989. As you know, the Department announced its list of seven best qualified sites in January. Detailed analysis of these sites is now in progress. In addition, the Department is actively seeking international collaboration and cost-sharing with other countries.

The SSC request includes $64.0 million in Operating Expenses. This will permit R&D on SSC technical systems to proceed at a substantially enhanced level in FY 1989. The work will focus on optimizing the design of the magnets and on industrialization of the magnet fabrication process.

In FY 1989 the SSC will have its first significant capital equipment requirements. The $16.0 million Capital Equipment request will provide equipment required to support the magnet R&D program for testing and analysis of magnets and for testing various other technical components and systems. The requested funds will provide for such equipment as power supply systems; a large helium refrigerator; test, control and measurement equipment; and components for detector development and prototyping.

The Construction request of $283.0 million will allow initial construction activities to proceed on a broad front in FY 1989. The request includes $39.0

million for detailed engineering design of technical systems and conventional facilities, $60.0 million for long-lead items for power stations and utilities distribution systems, $27.0 million for site preparation, $55.0 million for injector technical components which are early critical path items, $65.0 million for long lead procurements for collider components (including magnet tooling, superconducting materials and magnet steel) and $37.0 million for project management, support equipment and rental space.

In summary, I believe that the SSC demonstrates clearly the commitment of President Reagan and his Administration to pursue new initiatives in science and technology and, in doing so, to enhance the economic and technological health of the United States.

NUCLEAR PHYSICS

The goal of the Nuclear Physics program is to understand the structure and interactions of atomic nuclei. This understanding is essential to unraveling the mysteries of the world around us because nuclear processes determine the physical characteristics of our universe. For this very reason, advances in nuclear physics have both short and long-term effects well beyond the immediate boundaries of the field.

The results of nuclear physics research have made many contributions to our society and economy. For example, every hospital contains numerous examples of nuclear science at work. Especially prominent is the use of radioactivity and nuclear beams for diagnosis and therapeutic treatment of cancer. Nuclear energy makes a substantial contribution to the Nation's energy supply; the smoke detectors we have in our homes contain radionuclides; nuclear techniques in the form of ion implantation have revolutionized the semiconductor industry; and nuclear techniques for geophysical exploration, testing of materials, and archeological dating and siting are widely used.

The Nuclear Physics program continues to increase our knowledge of atomic nuclei as well as our capability to expand that knowledge base. Scientists now know that neutrons and protons, the constituents of the nucleus that are called nucleons, are composed of smaller constituents called quarks. These quarks are bound together in tightly knit groups of threes. However, scientists have not been able to isolate quarks outside the nucleus. It is as if quarks were tied together by elastic strings that cannot be broken. This confining mechanism forms the basis of the newest theory of the strong nuclear force, quantum chromodynamics.

The total Nuclear Physics program develops and supports a wide range of large and complex accelerator facilities which provide the beams of particles upon which the experiments are based. The diverse aspects of nuclear experimental research are addressed by using beams of light ions, heavy ions, electrons and protons over a wide range of particle energies. The collision of these beams with targets of atomic nuclei is the primary means by which scientists learn about the structure and forces acting within nuclei.

Among the program's accomplishments in 1987, the first gamma ray beam from the Laser-Electron-Gamma-Source (LEGS) at Brookhaven National Laboratory was produced. This unique facility produces gamma rays at a well-defined energy by bouncing ultraviolet light produced in a laser off the electrons in the circulating beam at Brookhaven's National Synchrotron Light Source (NSLS). The scattered light emerges with a much higher energy than it started with (thus becoming gamma rays with an energy of 300 million electron volts) as a result of the collisions with the electrons. By detecting the electrons from the NSLS beam which have been hit by the light, scientists can select a beam of gamma rays of the appropriate energy for use in experiments. LEGS is unmatched in the intensity and purity of the gamma ray beam it will provide for research. In addition, the gamma rays are 100 percent polarized, adding the unique aspects of spin to the photo-nuclear experiments planned for the new facility.

Also in 1987, Argonne's superconducting ATLAS system reached the limits of its current ion source and injector by accelerating ions with atomic masses of more than 120. ATLAS was the world's first working accelerator to use superconducting radio frequency cavities and has become a prototype for many other facilities throughout the world. A new positive-ion injector is under development that eventually will enable ATLAS to accelerate ions as massive as uranium, which is the heaviest stable element. In addition, a new recoil mass spectrometer is being installed to make most effective use of the new beams.

In addition to accelerator facilities, the Nuclear Physics and High Energy Physics programs support "nonaccelerator" experiments such as those to measure the lifetimes of protons and radioactive nuclei, to search for exotic particles and unusual modes of decay, or to open new windows on the universe through information provided by neutrino detectors. Using such detectors, physicists supported by the High Energy and Nuclear Physics program gathered important information about one of 1987's most spectacular scientific events. The brightest exploding star in the last 363 years, called a supernova, was observed several hours before its visible light reached the earth by one detector located deep in a salt mine under Lake Erie and a second which was deeply buried in the mountains of Japan. The detectors recorded a burst of neutrinos, which is the first time that neutrinos from outside our solar system have been observed. Neutrinos are the most abundant particles in the universe, but scientists know relatively little about their properties. Observation of the 1987 supernova not only provided information on the stability and mass of neutrinos, but also provided a key to the dynamics of the great explosion which marked the end of this star's life.

FY 1989 NUCLEAR PHYSICS BUDGET REQUEST

The FY 1989 budget request for the research portion of the Nuclear Physics program is $141.4 million. Of that total, $118.1 million is for Operating Expenses, $17.5 million is for Capital Equipment and $5.8 million is for Construction (Tables 8 & 9). I will discuss the Basic Research User Facilities request for Nuclear Physics after describing the Nuclear Physics research program request.

Table 8
General Science and Research
Nuclear Physics
Budget Authority
($ in millions)

	FY 1987	FY 1988	FY 1989 Request
Operating Expenses			
Medium Energy Nuclear Physics	$ 32.7	$ 35.5	$ 37.5
Heavy Ion Nuclear Physics	36.4	40.9	43.3
Low Energy Nuclear Physics	24.0	26.2	26.3
Nuclear Theroy	10.0	10.5	11.0
Subtotal	$103.1	$113.1	$118.1
Capital Equipment	$ 14.8	$ 16.6	$ 17.5
Construction	4.3	5.2	5.8
Total Nuclear Physics	$122.2	$134.9	$141.4

Table 9

Construction

Project	TEC	FY 1988	FY 1989 Request
Accelerator Improvements and Modifications (89-R-201)	$ 2.6	-	$ 2.6
Accelerator Improvements and Modifications (88-R-201)	2.3	$ 2.3	-
General Plant Projects (GP-E-300)	3.2	-	3.2
General Plant Projects (GP-E-300)	2.9	2.9	-
Total Construction		$ 5.2	$ 5.8

The FY 1989 Operating Expenses request will provide for continued experimental research on the basic structures and characteristics of nuclei and for the investigation of quarks within nuclei and of the fundamental forces of nature acting within extended nuclear matter. Research in low and medium energy nuclear physics, in heavy ion nuclear physics and in nuclear theory will continue at approximately the FY 1988 level. This research will focus on current problems of high scientific and technological interest and will continue to prepare the program to exploit major new facilities. Funding is also devoted to maintaining the effective operation of the upgraded accelerators at the University of Washington and Yale University, of the superconducting cyclotron at Texas A&M constructed with State and private funds, and of the Tandem/AGS high energy heavy ion facility at Brookhaven National Laboratory.

Operating funds also will support continued vigorous R&D aimed at providing a solid scientific and technical base for the planned relativistic heavy ion collider, one of four facilities identified by the scientific community as being critical to the future needs of the Department's basic research programs. Special emphasis will be made to accommodate training of young scientists and to ensure that the nuclear theory program accommodates the latest scientific priorities.

The FY 1989 Capital Equipment request of $17.5 million is needed to provide for particle detection systems, data acquisition and analysis systems and instrumentation to improve the performance of Nuclear Physics accelerators. These funds are essential for effective use of the accelerator and detector facilities operated by the Nuclear Physics program. The FY 1989 request will maintain the overall level of effort and will provide for general purpose equipment to meet the laboratory-wide needs of Lawrence Berkeley Laboratory.

The Construction request of $5.8 million includes $2.6 million for Accelerator Improvements and Modifications (AIM) and $3.2 million for General Plant Projects (GPP). These projects are needed to maintain the scientific effectiveness, reliability and efficiency of Nuclear Physics facilities. GPP projects focus on general laboratory facilities while AIM projects address the need for improvements to research accelerators and related experimental facilities.

BASIC RESEARCH USER FACILITIES--NUCLEAR PHYSICS (BRUF-NP)

The Nuclear Physics program requires the effective operation and maintenance of the accelerator facilities which provide the beams of particles upon which the experiments are based. The BRUF-NP program operates and maintains the following scientific user facilities: the Clinton P. Anderson Meson Physics Facility (LAMPF) at Los Alamos National Laboratory, the Bevalac at Lawrence Berkeley Laboratory, and the Tandem/AGS at Brookhaven National Laboratory. This program also funds construction of the major new facilities required to address the most important scientific questions. To meet this objective, construction of the Continuous Electron Beam Accelerator Facility (CEBAF) project was initiated in FY 1987.

The FY 1989 BRUF-NP request is for $122.7 million. Of that amount, $75.0 million is for Operating Expenses; $1.0 million for Capital Equipment and $46.7 million is for Construction (Tables 10 & 11).

The Operating Expenses request will support medium energy physics operations and facility maintenance at approximately the FY 1988 level of activity. The $49.6 million requested for this subprogram will support the operation of LAMPF as well as the light ion operation of the Bevalac. R&D activities required for the construction of CEBAF and preparation for operation of the laboratory are also carried out under the medium energy subprogram. The operation of heavy ion nuclear physics facilities at BNL and LBL will be supported at approximately the FY 1988 level of activity.

The $1.0 million Capital Equipment request is needed to provide for instrumentation to improve and maintain performance of Nuclear Physics accelerators at BNL, LBL and LANL.

Table 10
Basic Research User Facilities (BRUF)
Nuclear Physics
Budget Authority
($ in millions)

	FY 1987	FY 1988	FY 1989 Request
Operating Expenses			
Medium Energy Nuclear Physics	$ 47.9	$ 48.5	$ 49.6
Heavy Ion Nuclear Physics	23.9	24.3	25.4
Subtotal	$ 71.8	$ 72.8	$ 75.0
Capital Equipment	$ 1.1	$ 1.1	$ 1.0
Construction	19.8	36.3	46.7
Total BRUF-NP	$ 92.7	$110.2	$122.7

Table 11

Construction

Project	TEC	Prior Year	FY 1988	FY 1989 Request
Accelerator Improvements and Modifications (89-R-501)	$ 1.7	-	-	$ 1.7
Accelerator Improvements and Modifications (88-R-201)	2.1	-	$ 2.1	-
Continuous Electron Beam Accelerator Facility (87-R-203)	265.0	$ 16.2	33.5	44.5
General Plant Projects (GP-E-500)	0.5	-	-	0.5
General Plant Projects (GP-E-300)	0.7	-	0.7	-
Total Construction		$ 16.2	$ 36.3	$ 46.7

Of the total Construction request of $46.7 million, $44.5 million is for continued construction of CEBAF. The main research tool at CEBAF will be an accelerator with electron beams in the energy range of 0.5 to 4.0 GeV. Its combination of high-energy, high-current, and continuous beam with excellent beam quality is expected to revolutionize the production and collection of data for nuclear physics research. When CEBAF's energy is at its lowest, the electron beam will interact with the protons and neutrons that are the building blocks of nuclei. When its energy is at the high range, the electron beam from the accelerator will probe the underlying quark structures of protons or neutrons, providing a direct test of the newest concepts of nuclear matter, including quantum chromodynamics. Thus, the facility will provide the world's first capability to access the critical transition region between the traditional and emerging descriptions of nuclear matter.

The $44.5 million in FY 1989 Construction funds for CEBAF will be used for major hardware procurement of radiofrequency cavities and the central helium liquifier. Construction of the beam enclosure tunnel and support structures will continue. In addition, initial procurement of beam control apparatus and prototype power supplies will take place. Progress in FY 1988 includes complete preparation of the site, initial construction of the beam enclosure tunnel, procurement and testing of prototype superconducting accelerator elements, rehabilitation of an existing laboratory building, and approved architectural designs for the beam enclosure and office building. The remainder of the Construction request will support Accelerator Improvements and Modifications ($1.7 million) and General Plant Projects ($.5 million) at the existing facilities.

GENERAL SCIENCE PROGRAM DIRECTION

The FY 1989 budget request for General Science Program Direction is $3.2 million. This request is under the General Science and Research appropriation. The requested funds are required to provide for the salaries, benefits, travel and other expenses associated with 46 full-time equivalents in the Office of High Energy and Nuclear Physics and associated support staff required to administer these programs.

Now let me turn to the Basic Energy Sciences program.

BASIC ENERGY SCIENCES

Basic research is the first link in the chain of events from scientific discovery to economic growth through technological innovation. Results from research sponsored by the Basic Energy Sciences (BES) program become an integral part of the information base used in the development of the applied technologies within the Department and are equally important within the private sector. In addition to underpinning technology development, BES-supported research activities train our future scientists and help us attain our national goals--better health and quality of life, economic strength, energy self-sufficiency, national security--goals calling for continuing and significant technological advances.

The BES program annually supports approximately 1400 research projects at over 200 separate institutions with direct support for about 4000 investigators in the physical, biological, and mathematical sciences. These projects are selected on the basis of scientific excellence, relevance to DOE long-term goals, and their contribution toward a program responsive to the needs of the Nation. BES also provides funding for the supercomputer centers used for computation by the High Energy Physics, Nuclear Physics, and Biological and Environmental Research programs as well as for its own program.

The Basic Energy Sciences program undertakes research primarily at national laboratories and universities and, to a lesser extent, at private research laboratories and other government laboratories. The majority of BES-supported research is carried out at national laboratories. These laboratories are especially valuable in conducting basic research because researchers there also are involved in many aspects of the applied energy programs, thus facilitating transfer of scientific information and technology from experiment to application. In addition, the stability of the organization and specialized capabilities which exist at the laboratories in many instances are unmatched. The BES program also provides significant support to universities both directly and through the participation of university faculty members, postdoctoral students or graduate students in research at the national laboratories and at user facilities.

In addition to universities and national laboratories, BES supports research in and maintains strong ties with industry. Representatives from different industries serve on the BES Advisory Committee; experts from industry participate in the review of research proposals and use the specialized facilities sponsored by BES; industrial scientists participate in advisory committees to the national laboratories; and industry representatives are invited to attend BES conferences and workshops on special topics.

No summary of research results for such a diverse program can ever be complete or even fully representative of the program. Since the BES program covers such a wide spectrum of research, I can highlight only a few accomplishments in this statement. I would be happy to supply the Committee with additional representative accomplishments for each of our research areas.

Of special note, a BES project at UCLA has been recognized by a share of the 1987 Nobel Prize in Chemistry. The Prize was awarded to Professor Donald J. Cram of UCLA, Dr. Charles J. Pedersen of DuPont and Professor Jean-Marie Lehn of the Louis Pasteur University for developing new chemical methods for recovering scarce metals and purifying common metals using much less energy than in the past. Professor Cram's research program is providing new insight into the selective binding of materials which can "tie up" a valuable metal in the presence of other common ones and allow the new chemical combination to be extracted. The novel substances prepared by Cram's research team can bind molecules as well as metals and can be designed to mimic the highly specific activity of enzymes, the remarkable catalysts that are essential to all forms of life. Thus, in addition to the applicability of Cram's work to recovery of scarce metals and purification of waste streams of toxic or radioactive metals, the principles he has discovered also have widespread implications for the understanding of many processes that occur in nature.

In the materials sciences area, theoretical modeling of materials phenomena provides a basis for predicting the behavior of materials and can be very valuable in supporting experimental results and uncovering new phenomena. Recent application of a newly developed theoretical technique has resulted in the calculation of stress levels that cause brittle cracks to grow in materials. This knowledge will help us to determine safe stress levels without the time consuming process of testing every possible composition and structure.

An important "first," the demonstration of the x-ray laser, received one of the 1987 IR-100 awards which are presented annually by Research & Development magazine to the 100 most significant new technical products in the world. When fully developed for microscopy purposes, laser-based x-ray microscopy offers, for the first time, the prospect of observing the insides of living cells, including the distribution of chemical elements within a cell. The first microscopic images using the x-ray laser were recently obtained but the wavelength of the laser is still too long to image the cells; further work is in progress.

Last year was also an important year in the development of high-temperature superconductors. Although superconductivity was discovered in 1911, applications to date have depended on cooling with liquid helium. At the end of 1986, a breakthrough occurred in the temperature limit and newly developed "high-temperature" materials have now been found which superconduct above the temperature of liquid nitrogen which is considerably cheaper and easier to use than liquid helium. To take advantage of the discovery of the new class of high-temperature superconductors, the Office of Basic Energy Sciences has supported research aimed at addressing scientific and technical obstacles that must be overcome to use the new materials in technologically important systems. The BES research program is addressing fundamental questions regarding the mechanism by which the new high-temperature superconductor materials become superconducting, the key to finding even better new materials. The program also is addressing the synthesis of new materials to expand the range of these parameters.

The national laboratory structure and the availability of BES's major user facilities have been critically important to the ability of the BES program to quickly redirect research into this important area. Although the funding request for these facilities is now under the Basic Research User Facilities appropriation which is discussed later in my statement, I would like to discuss some of the contributions being made by BES research to our ever-growing understanding of high-temperature superconductors.

Within a few weeks after the discovery of the new higher temperature superconductors, scientists at Argonne National Laboratory's Intense Pulsed Neutron Source carried out neutron scattering studies of the yttrium-barium-copper oxide material and produced definitive results on its structure. This new information on the exact arrangement of the atoms in the compound has provided the basis for understanding all of the subsequent experiments conducted and theories developed to understand why these compounds are superconducting at such high temperatures.

At the High Flux Beam Reactor (HFBR), scientists are learning more about two phenomena that play a key role in high-temperature superconducting materials, atomic vibrations and the properties of electrons within these materials. Neutron scattering studies of atomic vibrations have confirmed scientists' belief that the behavior of these materials is similar to conventional low-temperature superconducting materials. However, other neutron scattering research at HFBR led to unexpected behavior related to electron properties giving rise to magnetism. Specifically, in the pure lanthanum-copper oxide material, the copper oxide sheets exhibit a novel type of magnetic order at quite high temperatures. Thus, from the neutron scattering results, one normal and one unanticipated, a number of questions still remain that have to be explored further.

Synchrotron radiation also is useful to study electron properties in materials. By illuminating the superconductors with light from Brookhaven's National Synchrotron Light Source (NSLS), it was possible to excite the electrons from the different atoms and determine their energies or velocities within the material. Studies of the yttrium-barium-copper oxide superconductor showed that the electrons do not have energies as high as the calculations would suggest and that only a small number of electrons have the highest energy. This latter observation is contrary to what had normally been anticipated for superconductors. This work was one of the first reported photoemission studies of the high-temperature superconductors and the unusual results have now been confirmed by other groups.

FY 1989 BASIC ENERGY SCIENCES BUDGET REQUEST

The FY 1989 budget request for the research portion of the BES program is $375.6 million. Of the total, $344.4 million is for Operating Expenses; $25.6 million is for Capital Equipment; and $5.6 million is for Construction (Tables 12 & 13). The overall increase in funding for the Basic Energy Sciences program is 3 percent if FY 1988 Congressionally initiated projects are excluded. This request falls under the Energy Supply R&D appropriation. I will discuss the Basic Research User Facilities request for BES separately.

The Operating Expenses request will allow us to conduct research aimed at uncovering new energy-related information in materials sciences, chemical sciences, applied mathematical sciences, engineering and geosciences, energy biosciences and advanced energy projects. Specifically, the FY 1989 budget will provide the necessary resources to maintain the existing core program in each of the subprograms in BES and to permit initiation of a limited number of new research projects in those areas that have the highest scientific merit.

No two areas of scientific research illustrate better the stakes, promises, and consequences of research funding better than semiconductors and superconductors, which are funded in our Materials Sciences subprogram. Each holds out the hope of new technological advances. Future developments in computers, transportation, energy, defense, and medicine will be affected by the speed at which advances take place in these technologies.

Table 12
Energy Supply R&D
Basic Energy Sciences
Budget Authority
($ in millions)

	FY 1987	FY 1988	FY 1989 Request
Operating Expenses			
Materials Sciences	$118.6	$126.0	$134.6
Chemical Sciences	79.2	88.2	93.1
Applied Mathematical Sciences	38.3	42.4	43.0
Engineering and Geosciences	29.1	31.4	33.4
Advanced Energy Projects	12.6	14.3	14.6
Energy Biosciences	16.3	20.2	20.8
Program Direction	4.1	4.5	4.9
Subtotal	$298.2	$327.0	$344.4
Capital Equipment	24.6	25.0	25.6
Construction	109.4	85.1	5.6
Total Basic Energy Sciences	$432.2	$437.2	$375.6

Table 13

Construction

Project	TEC	FY 1988	FY 1989 Request
Accelerator Improvement Projects (89-R-401)	$ 0.7	-	$ 0.7
General Plant Projects (89-R-400)	4.9	-	4.9
General Plant Projects (88-R-400)	4.9	$ 4.9	-
Center for Advanced Materials (84-ER-112)	40.2	7.6	-
Congressionally Initiated University Projects		72.6	-
		$85.1	$ 5.6

The discoveries and advances in these areas have the entire scientific community excited. In high-temperature superconductivity, the Operating Expenses request will continue to fund research on methods for preparing superconducting materials with better properties, such as higher critical currents. Newer materials are also being investigated to understand the structure and mechanism of high-temperature superconductivity. The FY 1989 request includes $16.7 million, an increase of $1.5 million, for high-temperature superconducting research in the BES program.

The Department has played an important role in the development of the U.S. semiconductor technology base and continues to support research in this area. Semiconductors are materials that form the base for all solid state microelectronics circuitry. In FY 1989, semiconductor research supported by the Basic Energy Sciences program will continue to emphasize the science related to compound semiconductors and to provide synchrotron radiation useful to the Nation's researchers in studies of semiconductors. The FY 1989 level of funding in research related to semiconductors is planned to be about the same as in FY 1988, approximately $7.0 million.

Continued support will also be provided in FY 1989 for basic combustion research which will be important for providing advances in coal technology, engines, and for handling the spectrum of environmental problems in any combustion system. The level of funding in FY 1989 will be $15.1 million, an increase of $0.3 million. Scientists are uncovering new knowledge about the chemistry and kinetics of combustion that ultimately will enable automobile companies and utilities to improve operating systems.

The FY 1989 request for Program Direction is $4.9 million. These funds are required to pay for the personnel costs of 63 full-time equivalents to direct, manage, and support BES's multidisciplinary research efforts.

The Capital Equipment request for FY 1989 is $25.6 million. These funds will ensure that BES-supported researchers will continue to have the equipment needed to conduct advanced research, much of which involves experiments at extremes of temperature and pressure. Reliable, precise measurements under these conditions challenge the current state-of-the-art. Replacements and new equipment funded under this request, which are important to the continued success of the program, include such items as electron microscopes, neutron spectrometers, molecular beam equipment and computers for equipment control and data analysis.

The Construction request for FY 1989 is $5.6 million. This request includes continued funding for General Plant Projects and Accelerator Improvement Projects. Each of these categories is comprised of several smaller projects which are necessary to maintain plant and facilities at several DOE laboratories. The projects include a wide spectrum of improvements from roads and buildings to safety and security upgrades necessary to protect property and personnel and to modify existing scientific facilities to allow the most cost-effective utilization of their technical capabilities.

BASIC RESEARCH USER FACILITIES - BASIC ENERGY SCIENCES (BRUF-BES)

The remaining part of the Basic Energy Sciences program which I would like to discuss falls under the Basic Research User Facilities (BRUF) appropriation. Within the Basic Energy Sciences program, seven existing major user facilities are included in this new appropriation together with R&D, capital equipment and construction funding for two new facilities under construction. The seven existing facilities are: the High Flux Beam Reactor and National Synchrotron Light Source at Brookhaven National Laboratory, the Combustion Research Facility at Sandia-Livermore, the Stanford Synchrotron Radiation Laboratory (SSRL) at Stanford University, the Intense Pulsed Neutron Source at Argonne National Laboratory, the Los Alamos Neutron Scattering Center at Los Alamos National Laboratory, and the High Flux Isotope Reactor (HFIR) and the Transuranium Processing Plant at Oak Ridge National Laboratory. HFIR is currently being refurbished, and we expect it to restart later this year. One of the new facilities, the 1-2 GeV Synchrotron Radiation Source at Lawrence Berkeley Laboratory is already under construction, and funding is being requested to initiate construction of a second new facility, the 6-7 GeV

Synchrotron Radiation Source at Argonne National Laboratory. Each of these seven facilities is unique in the capabilities which it offers the scientific and engineering community; and the success and promise of these facilities in meeting the Nation's research needs has been praised by many high-level committees.

Earlier, I mentioned some of the many accomplishments, primarily in the area of superconductivity, made possible by the existence of these facilities which are the key to research progress in many fields, including the physical, biological and mathematical sciences. Their availability to a wide range of researchers from academia, industry, and other government laboratories makes them especially valuable to the Nation. To gain a better understanding of their scientific and, ultimately, economic importance one only has to look at the community of users involved in research at the National Synchrotron Light Source (NSLS). Table 14 shows some of the many university, industry and government organizations that take advantage of the research capabilities at NSLS.

In addition to allowing many non-DOE researchers to carry out research directly at these facilities, some of these facilities produce research materials that are made available to other organizations. For example, the High Flux Isotope Reactor (HFIR) and Transuranium Processing Plant at ORNL have produced two isotopes used in cancer therapy research supported by the National Cancer Institute. Einsteinium-253 and fermium-255, which emit alpha particles with short half lives, are bound to monoclonal antibodies which are able to direct these radionuclides and cytotoxic drugs to malignant sites. Alpha emitters are ideal for cancer therapy because their entire radiation energy is confined to a very small range. Therefore, the number of alpha "strikes" required to kill a cancer cell is much smaller than for other types of radiation. It is also important that alpha emitters to be used in cancer therapy have relatively short half-lives so that the radiation dose to the patient can be better controlled.

Table 14
Basic Energy Sciences
Basic Research User Facilities
National Synchrotron Light Source
(Sample of Users)

Universities	Industry	Government
University of California	AT&T	National Bureau of Standards
Georgia Institute of Technology	Exxon	National Institutes of Health
Georgia State University	IBM	Naval Research Laboratory
Harvard University	Mobil	Veterans Administration
University of Illinois	Celanese	Lawrence Livermore National Laboratory
Louisiana State University	Allied Signal	Los Alamos National Laboratory
Massachusetts Institute of Technology	Union Carbide	Sandia National Laboratories
Michigan State University	3M	
University of New Orleans	Boeing	
University of North Carolina	Chevron	
Northwestern University	Smith, Klein and French	
University of Oregon	SRI	
University of Pennsylvania	Xerox	
Princeton University		
University of South Carolina		
Stanford University		
University of Texas		

The FY 1989 budget request for BRUF-BES is $140.5 million. Of that total, $86.3 million is for Operating Expenses; $6.1 million is for Capital Equipment; and $48.1 million is for Construction (Tables 15 & 16).

The BRUF-BES Operating Expenses request of $86.3 million provides for continuing the operation of the seven existing facilities funded in this account, including HFIR which, as I already indicated, is in a stand down condition but being readied for restart. Within the Operating Expenses request, $8.2 million is necessary to continue R&D activities associated with the 1-2 GeV Synchrotron Radiation Source at LBL and the 6-7 GeV Synchrotron Radiation Source at ANL. The R&D funds for the former are focused on improvements to the magnet lattice and related activities. For the 6-7 GeV Source, research activities will focus on prototypes of the dipole magnets and insertion devices.

Reliable, precise measurements at the seven BES facilities challenge the current state-of-the-art; and improvements and replacement hardware are necessary in a timely fashion. The Capital Equipment request of $6.1 million provides for high priority synchrotron radiation equipment and neutron scattering equipment.

Of the $48.1 million BRUF-BES Construction request, $30.0 million is for the 1-2 GeV Synchrotron Radiation Source. The unique capabilities at this new facility will allow investigators from industry, universities and national laboratories to carry out new studies in many fields, including materials science, atomic and molecular physics, chemistry and biology. The FY 1989 request will permit continued construction and procurement activity leading to completion of the facility in 1992.

The Construction request also includes $6.0 million to initiate construction of the 6-7 GeV Synchrotron Radiation Source. This new facility would not only provide an advanced scientific capability unmatched in the United States, it also would provide much needed additional capacity in the hard x-ray region. As a third generation radiation synchrotron source, it will be used by many

Table 15
Basic Research User Facilities (BRUF)
Basic Energy Sciences
Budget Authority
($ in millions)

	FY 1987	FY 1988	FY 1989 Request
Operating Expenses			
National Synchrotron Light Source	$ 18.5	$ 19.6	$ 20.3
High Flux Beam Reactor	10.0	10.9	11.5
High Flux Isotope Reactor/ Transuranium Processing Plant	15.8	22.7	23.7
Intense Pulsed Neutron Source	5.0	5.0	5.4
Stanford Synchrotron Radiation Laboratory	9.8	10.3	10.5
Los Alamos Neutron Scattering Center	1.3	3.0	3.1
Combustion Research Facility	3.5	3.5	3.6
6-7 GeV Synchrotron Radiation Source	2.0	10.0	6.2
1-2 GeV Synchrotron Radiation Source	1.5	2.0	2.0
Subtotal	$ 67.4	$ 87.0	$ 86.3
Capital Equipment	6.5	6.7	6.1
Construction	13.3	31.8	48.1
Total BRUF-BES	$ 87.2	$ 125.5	$140.5

Table 16
Basic Research User Facilities
Basic Energy Sciences
Budget Authority
($ in millions)

Construction

Project	TEC	Prior Year	FY 1988	FY 1989 Request
6-7 GeV Synchrotron Radiation Source (89-R-601)	$456.0	$ -	$ -	$ 6.0
Accelerator Improvement Projects (89-R-600)	1.6	-	-	1.6
Accelerator Improvement Projects (88-R-600)	2.3	-	2.3	-
3 GeV Spear Injector (88-R-403)	14.0	-	3.0	6.5
1-2 GeV Synchrotron Radiation Source (87-R-406)	98.7	1.5	18.0	30.0
Neutron Scattering Experimental Hall (87-R-403)	17.5	5.0	8.5	4.0
Total Construction		6.5	31.8	48.1

scientific disciplines to investigate new materials, surfaces, biological molecules, chemical reactions and geological materials. For these studies, the unprecedented quality of the x-ray radiation, including the intensity, coherence and time structure, will certainly provide the U.S. with important new discoveries. The need for this facility has been agreed upon by several organizations, including the National Academy of Sciences and the Department's Energy Research Advisory Board. This facility has received the highest priority recommendations from these groups.

The BRUF-BES Construction request also includes $6.5 million to continue construction of the 3 GeV SPEAR Injector so that synchrotron radiation experiments at Stanford Synchrotron Radiation Laboratory can proceed independently instead of relying on the availability of the SLAC linear accelerator which also injects into the Positron-Electron Storage Ring and the Stanford Linear Collider; $4.0 million to continue construction of the Neutron Scattering Experimental Hall at the Los Alamos Neutron Scattering Center; and $1.6 million for accelerator improvement projects at the National Synchrotron Light Source and the High Flux Beam Reactor.

The next program I would like to discuss is Magnetic Fusion Energy.

MAGNETIC FUSION ENERGY

The Magnetic Fusion Energy program is an important part of the Department's efforts to assure an adequate supply of energy for the Nation at a reasonable cost. The Program's goal is to establish the scientific and technological base for fusion energy early in the next century. This schedule would allow a timely assessment of the role of fusion energy in the Nation's energy future.

The Magnetic Fusion Energy program is being conducted according to the Magnetic Fusion Program Plan which was developed in 1985. This Plan took into consideration the constraints on Federal spending, the uncertainty of energy supplies, the excellent technical progress in fusion research, the Program's ability to train creative scientists and engineers, the contribution of fusion to basic research in the fields of plasma physics and atomic physics, and the important role of this Program in technology transfer to industry.

The Program Plan elaborates on the strategy for providing the scientific and technological base for fusion. This two-fold strategy is: 1) to maintain a strong domestic R&D program to adequately cover the necessary range of fusion science and technology issues and 2) to use international collaboration to advance the program in a timely way.

The Fusion Program Plan and the Department's strategy for meeting its goal have undergone several reviews recently. The Department's Energy Research Advisory Board (ERAB) conducted its Congressionally mandated triannual review in the last year. ERAB also looked at fusion as part of its review of the National Research Council report "Physics Through the 1990's." In addition, the Magnetic Fusion Advisory Committee held numerous reviews. All of these groups have endorsed the Department's Plan and strategy for meeting its fusion goals.

A strong domestic program, as called for by the Department's strategy, must include work on each of four key technical issues: the properties of burning plasmas, magnetic confinement systems, fusion materials, and fusion nuclear technology. The FY 1989 budget request provides for a U.S. Magnetic Fusion Energy program focused clearly on these key technical issues and interwoven with other world fusion programs through international collaboration. Let me take a moment to comment on these issues.

The first issue concerns the properties of burning plasmas. An understanding of these properties is required to complete the scientific base for fusion. No experimental facility presently exists anywhere in the world to investigate this fundamental issue. The United States is in the best technical position to proceed with such an experiment, utilizing the scientific personnel and infrastructure at Princeton Plasma Physics Laboratory (PPPL). As part of joint international planning to avoid duplication of costly facilities, the European Community and Japan have encouraged the United States to undertake a

Compact Ignition Tokamak (CIT) to provide critical information to support operation of a next step engineering test reactor, now called the International Thermonuclear Experimental Reactor (ITER). The ITER is essential for completing the technical base of fusion. The U.S. has proposed a joint effort, including the Soviet Union, Japan, and the European Community, to develop a single conceptual design for an ITER by the end of 1990. I will discuss the status of this proposal later in my statement.

Achievement of ignition has always been a major objective of magnetic fusion research. Furthermore, CIT is the only proposed experiment in the world-wide program aimed at addressing the most fundamental scientific issue for fusion, that of understanding burning plasma physics. It is also the natural and cost-effective follow-on to the Tokamak Fusion Test Reactor (TFTR) program. We have now reached the point where experimental progress justifies proceeding with an ignition experiment. The Department believes that CIT is critical to the development of fusion energy and to the U.S. Magnetic Fusion Energy program, and it should be noted that CIT is the only deuterium-tritium experiment proposed for the period between the TFTR in the U.S. and a future engineering reactor.

The schedule for the CIT project, for which the architect-engineering design has been initiated this fiscal year, is influenced by both domestic and international program considerations. A timely U.S. CIT would provide vital information to the world program on how to operate an ITER in the ignited mode and would, thus, save several years of costly exploratory research on the reactor itself. The CIT schedule should allow the facilities and personnel at PPPL, which will complete the TFTR program in 1991, to be productively employed in addressing the important issue of understanding burning plasma physics. The Magnetic Fusion Advisory Committee, the Energy Research Advisory Board, and an international scientific review team have all endorsed the scientific importance of this experiment. The funding proposed in this budget request would allow the U.S. to use the information base available from current experiments both to prepare for its own next step and to support the world fusion program.

The second key technical issue concerns magnetic confinement systems. Although significant progress continues to be made in understanding the confinement process, we do not have enough scientific knowledge at this time to design a fusion reactor that is suitable for commercial application. We must, therefore, continue to investigate several confinement systems at modest levels in order to provide this scientific knowledge. Research on this key issue is being closely coordinated internationally to maintain the broadest scientific coverage at minimum cost.

The third key issue concerns materials for fusion systems. Materials research is vital to a successful experimental Magnetic Fusion Energy program, as well as to realizing the ultimate benefits of fusion. Achievement of the Program goal will require the development of new materials to reduce the induced radioactivity and, thereby, enhance the economic and environmental potential of fusion, as well as the development of the facilities required for testing these materials. As part of the Program's international strategy, this issue is being pursued through cooperative agreements. The proposed FY 1989 budget supports the core program needed for U.S. participation in this international effort.

The fourth key issue concerns the nuclear technology of fusion systems. Resolution of this issue requires advances in the basic engineering sciences, as well as application of the results of basic fusion materials research. This issue will be completely resolved only when fuel-producing blankets are integrated into other fusion systems and tested in a nuclear environment, such as ITER. A fusion blanket performs several functions, including converting the energy released by a fusion reaction into useful energy, creating part of the fuel for the reactor, and allowing for recovery of this fuel, as well as shielding critical components from radiation. Our FY 1989 budget request supports the basic technology research that underlies the development of integrated blankets for the long-term and for the ITER conceptual design and validating R&D process in the near-term.

International collaboration has become a major resource for the development of fusion energy. The fusion program has a long history of scientific exchange and cooperation. The Economic Summit process has provided a mechanism for developing an integrated fusion program for the Western allies. Through a series of important international collaborative arrangements, the program has made a great deal of progress toward this goal in the past four years. As noted earlier, the U.S. has proposed a joint effort including the USSR, Japan and the European Community to develop a single conceptual design for the ITER by the end of 1990. After formal discussions among the four parties, the International Atomic Energy Agency issued an invitation to the parties to participate. The U.S., Japan, the European Community, and the USSR all have accepted the invitation. We plan to begin a joint design effort on May 2, 1988. This budget provides for continued U.S. participation in the conceptual design and validating R&D for an international ITER during FY 1989.

The FY 1988 Appropriation Act directed the Department of Energy to submit a five-year budget plan showing how the Compact Ignition Tokamak could be built while completing the Tokamak Fusion Test Reactor program within current budgetary resources. A summary of the plan is included in the FY 1989 budget (Table 17). This plan has been developed recognizing the need for both a balanced base program and preparation for a future program. It focuses the U.S. Magnetic Fusion Energy program strongly on ignition physics issues based on TFTR and CIT. The plan maintains a limited number of recent initiatives aimed at improving toroidal confinement and continues awareness programs in long-range technology. International commitments, including participation in ITER, will all be met under this plan.

In summary, this budget provides for a U.S. fusion program focused clearly on the key technical issues and interwoven tightly with other world fusion programs through international collaboration.

FY 1989 MAGNETIC FUSION ENERGY BUDGET REQUEST

The FY 1989 budget request for Magnetic Fusion Energy is $360.0 million. The request includes $317.5 million for Operating Expenses, $21.6 million for

Table 17
MAGNETIC FUSION ENERGY
OUTYEAR BUDGETS/(ESCALATED DOLLARS)
(dollars in millions)

	FY 1988	FY 1989	FY 1990	FY 1991	FY 1992	FY 1993
Compact Ignition Tokamak Total	15.5	27.0	46.0	64.0	95.0	101.0
Tokamak Fusion Test Reactor	72.1	74.3	83.0	79.0	45.0	42.0
Total Ignition	(87.6)	(101.3)	(129.0)	(143.0)	(140.0)	(143.0)
Princeton Beta Exp.	11.1	11.4	-	-	12.0	13.0
Alcator C-Mod.	10.1	15.5	16.0	16.0	17.0	17.0
Adv. Toroidal Fac.	18.1	18.0	19.0	19.0	20.0	21.0
DIII-D	29.7	32.5	33.0	35.0	46.0	48.0
Microwave Tokamak Exp.	9.3	10.5	10.0	11.0	-	-
International/Other	7.2	6.6	6.0	7.0	8.0	8.0
Mirrors	3.6	3.0	3.0	-	-	-
Conf. Sytems Total	176.7	198.8	216.0	231.0	243.0	250.0
Base Dev. & Tech.	42.4	42.3	41.0	40.0	41.0	44.0
International Thermonuclear Exp. Reactor**	16.0	16.0	16.0	17.0	18.0	19.0
Dev. & Tech. Total*	58.4	58.3	57.0	57.0	59.0	63.0
Applied Plasma Physics*	78.0	80.6	79.0	80.0	82.0	87.0
General Plant Projects/ General Purpose Equip./ Program Direction	21.9	22.3	23.0	24.0	25.0	26.0
Office of Fusion Energy Total	335.0	360.0	375.0	392.0	409.0	426.0

* Basic R&D in support of the CIT program will be continued, as appropriate.

**Conceptual design report for ITER to be completed in 1990; outyear projections include level of effort, no construction.

Table 18
Magnetic Fusion Energy
($ in millions)

	FY 1987	FY 1988	FY 1989 Request
Operating Expenses	$315.4	$298.4	$317.5
Capital Equipment	18.0	19.7	21.6
Construction	8.2	16.9	20.9
Total	$341.6	$335.0	$360.0

Capital Equipment and $20.9 million for Construction (Table 18). This request will support experimental investigations that are essential to continued research progress and will maintain a balance between our domestic science and technology program and foreign programs with the goal of allowing international collaboration to supplement our domestic research activities.

The request of $360.0 million will allow us to continue work on the four key technical issues discussed earlier in my statement. It will support construction of the Compact Ignition Tokamak device and efforts to develop a common international conceptual design for ITER. To maintain progress at this level of funding, the Program continues to be focused primarily on the investigation of toroidal confinement systems. In addition, we continue to focus the Program on the highest priority tasks, improve the cost effectiveness of facility operations and increase the use of international collaboration in all areas.

The Operating Expenses request of $317.5 million reflects about a 6 percent increase. This increase provides for constant dollar funding for most elements of the program and for increases to meet project funding requirements associated with R&D support and construction of the CIT, preparations for deuterium-tritium operations in TFTR, fabrication of the Alcator-C Mod device, and of the Confinement Physics Research Facility. Work in the technology development area will focus on only the most critical feasibility issues, while providing support for CIT and the Presidential initiative to design and conduct validating R&D for ITER.

Let me now summarize the Operating Expenses request for each of the interrelated functional areas within the Magnetic Fusion Energy program: Confinement Systems, Applied Plasma Physics, Development and Technology, Planning and Projects, and Program Direction (Table 19).

The Confinement Systems subprogram, with an FY 1989 Operating Expenses request of $175.6 million, supports large-scale physics experiments to address key physics issues associated with heating and containing high-temperature plasma. Confinement Systems also develops an information base on reactor-relevant plasma conditions.

In FY 1989, continued studies related to the confinement of high-temperature plasmas will be conducted at the TFTR at Princeton Plasma Physics Laboratory, with preparation for the deuterium-tritium breakeven experiment and studies of plasma confinement at increasing power levels. TFTR has already achieved central plasma ion temperatures of over 300,000,000°C, a value which is more than adequate for a commercial thermonuclear reactor; and also has achieved world record values of the fusion confinement parameter which are also adequate for achieving ignition. Breakeven with deuterium-tritium fuel is expected in 1991. The FY 1989 Operating Expenses request also continues the design and R&D effort aimed at building the CIT. Aspects of the CIT design, experimental objectives, and physics studies are specifically directed, wherever possible, to be relevant to ITER.

At the DIII-D device at General Atomics, scientists will continue to explore the ratio of plasma energy to magnetic energy, a ratio characterized as "beta." Higher magnetic fields require larger, more costly magnets. Therefore, experiments are carried out with alternate plasma shapes and operating modes predicted to increase beta. In 1987, a world record beta of 6.2 percent, compared to the previous record of 5 percent, was achieved and sustained without disruptions for several hundred milliseconds. A vigorous experimental program to assess the properties of high-temperature, high-pressure, non-circular plasmas in support of CIT design work is continuing at DIII-D in collaboration with the Japanese.

Table 19
Magnetic Fusion Energy
Budget Authority
($ in millions)

	FY 1987	FY 1988	FY 1989 Request
Operating Expenses			
Confinement Systems	$184.8	$158.6	$175.6
Applied Plasma Physics	75.2	74.8	78.2
Development and Technology	50.5	55.9	54.1
Planning and Projects	0.9	4.5	5.0
Program Direction	4.0	4.6	4.6
Subtotal	$315.4	$298.4	$317.5
Capital Equipment	18.0	19.7	21.6
Construction			
Compact Ignition Tokamak	0	8.0	12.0
General Plant Projects	8.2	8.9	8.9
Subtotal	$ 8.2	$ 16.9	$ 20.9
Total	$341.6	$335.0	$360.0

In addition to the facilities already mentioned, fabrication of the Alcator-C Modification at the Massachusetts Institute of Technology (MIT) also will continue. This facility will confirm various aspects of the CIT design, physics assumptions, and projected operating modes. The Microwave Tokamak Experiment, being fabricated at Lawrence Livermore National Laboratory (LLNL) using the old Alcator-C device from MIT, will be completed in FY 1988 with initial operation expected in FY 1989. This device will provide the unique capability to test the application of pulsed high power microwaves as a more efficient heating technique in tokamak devices. The FY 1989 request also provides for continued operation of the Advanced Toroidal Facility (ATF) stellarator at Oak Ridge National Laboratory (ORNL) and the Princeton Beta Experiment at PPPL. The Major Device Fabrication for the ATF was completed in December 1987. Plasma operation was initiated in January 1988 with 200 KW of electron cyclotron heating, and neutral beams were injected in February. Research at ATF will contribute to the advancement of toroidal physics and to the international collaborative effort on stellarators.

International collaboration will be relied on to carry out research on a number of related plasma issues in foreign facilities including TEXTOR and ASDEX in West Germany, Tore Supra in France, the Joint European Torus (JET) in

Europe and JT-60 in Japan. In just one example of the ongoing collaboration at these facilities, ORNL and PPPL have fabricated and installed a 3-barrel, high speed pellet injector on JET as a part of the U.S.-European Community cooperation. Last December, the first in a series of pellet injection experiments resulted in the highest density in a JET plasma with ion cyclotron heating. These experiments, which are essential to achieving the required high fusion confinement parameters, are continuing.

The Applied Plasma Physics subprogram, with an FY 1989 request of $78.2 million, develops plasma physics theories and models to predict and explain the experimental and theoretical investigations of basic physics problems related to confinement concepts. This subprogram also conducts research on magnetic confinement configurations with potentially improved reactor features, provides computational support to the program, and develops diagnostic instruments for use by the Confinement Systems subprogram.

Significant progress has been made in understanding physical processes that reduce confinement of particles within tokamaks. Several advanced diagnostic techniques were applied by a collaboration of university groups at the TEXT tokamak to obtain the new measurements. Through theoretical efforts, these insights will impact our understanding of the critical, related issue of energy confinement in tokamaks.

Exploratory experiments on a small toroidal device recently found highly efficient production of the plasma current, which is required to form the tokamak configuration, through application of an electron "beam" at the plasma edge. Improved current drive efficiency is a critical reactor feature for tokamaks. These initial experiments will be advanced to a moderate sized tokamak during FY 1989.

The spheromak, a compact toroidal plasma with no hardware on the inside of the torus, is one of the alternate confinement concepts being investigated under this subprogram. The S-1 experiment at Princeton has completed a 4-year research program that demonstrated plasma compression heating, one of several methods of heating the plasma, and confirmed the pioneering theory of "energy minimum" confinement. This theory determines generally how the magnetic fields and stored energy evolve in all toroidal plasmas.

Other alternative confinement concepts that will continue to be investigated in FY 1989 are the Reversed Field Pinch (RFP) and Field Reversed Configuration (FRC). Both devices make efficient use of magnetic fields. In addition, RFP devices require no auxiliary heating, while FRCs have simple magnetic fields and offer natural systems for impurity control. The FY 1989 request for the Applied Plasma Physics subprogram reflects a slight increase primarily to continue fabrication of the Confinement Physics Research Facility (CPRF) at Los Alamos National Laboratory. Support for the theory, experimental research and computer network elements of this subprogram will continue at a flat level with some decreases in scope of work to accommodate the increased cost of operations.

The Development and Technology subprogram, for which $54.1 million is requested in FY 1989, develops components and systems for use in near- and mid-term fusion experiments, as well as long-term generic materials and fusion nuclear technology. This subprogram also performs conceptual design studies for future fusion devices. These design studies identify component and system development needs that must be met to prepare for the eventual application of fusion.

In FY 1987, the International Energy Agency Large Coil Task testing program at ORNL was completed to the satisfaction of all participants, the U.S., Japan, the European Community, and Switzerland. Based on the results of this program, we are now confident that we can design and build the required large superconducting magnets for fusion.

Organization of the U.S. ITER activities has been completed, including Technical Study Tasks and R&D to validate design concepts. In FY 1989, design and R&D work will continue in support of ITER. These efforts will include international collaboration on development of high field, steady state magnets; research on improved techniques for heating, current drive and plasma control; development of higher performance pellet injectors; research on tritium recycling technology and safety and environmental issues; and materials development in support of the ITER design.

The Planning and Projects subprogram primarily provides support for construction of major new facilities and fabrication of auxiliary components for these facilities. The FY 1989 Operating Expenses request for $5.0 million is for the support of special program needs and for compliance with legislative requirements associated with the Small Business Innovation Research (SBIR) program.

The Operating Expenses request of $4.6 million for Program Direction provides for personnel and other costs associated with continuation of 62 full-time equivalent staff.

The FY 1989 Capital Equipment request of $21.6 million will provide for essential hardware necessary to support the Program, such as power supplies, diagnostic and computer equipment and components for experimental facilities. The increase in the Capital Equipment request is primarily in the Toroidal Confinement Systems area and the Development and Technology area.

The FY 1989 Construction request of $20.9 million provides $12.0 million for the Compact Ignition Tokamak that I discussed earlier. A national design team has been working for several years to develop a low-cost concept that would provide a compact, high field, copper coil tokamak facility to generate critical burning plasma data to allow for successful operation of an integrated ITER. The project, with a TEC of $426 million, began in FY 1988 and is scheduled to be completed in FY 1996. The funds requested for FY 1989 will provide for design, long-lead-time procurement, and initial construction of the CIT device components and systems. The remainder of the Construction request, $8.9 million, is for General Plant Projects. These projects at LLNL, PPPL and ORNL provide for the continuing minor alterations and modifications necessary to protect the government's investment in its facilities.

Now let me turn to the Biological and Environmental Research program.

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

The Biological and Environmental Research (BER) program supports research aimed at accomplishing two important goals. The first goal is to develop the basic knowledge necessary to identify, understand and anticipate the long-term health and environmental consequences of energy use and development. The second is to use the Department's unique scientific and technological capabilities to solve major scientific problems in medicine and biology.

Over the years, the BER program has greatly improved our ability to understand and predict the long-term health and environmental effects of energy technologies. Researchers supported by this Program have, among their many contributions: (1) produced most of the health effects data needed to establish the human radiation exposure standards in world-wide use; (2) developed most of the radiation detection systems and measurement techniques used to protect nuclear industry workers and the general public; (3) established the concept of studying the environment as an interactive, integrated medium for the cycling and transport of pollutants; and (4) provided training and research experience for most of the Nation's radiation biologists, radiological physicists and radioecologists.

The resources used by the Department to develop new scientific knowledge and technologies, such as the examples I have just mentioned, have also made major contributions to the study, diagnosis and treatment of human diseases, and to the resolution of major problems in the biological and environmental sciences. BER's contributions in nuclear medicine are a clear example. This research, based on the Department's capabilities in high energy physics, radiation chemistry and isotope separation, has produced the technology for the millions of nuclear medicine diagnostic and therapeutic procedures performed annually. In addition to the obvious human benefits of nuclear medicine procedures, these developments have also helped create a substantial industry that supplies radioisotopes and nuclear medical equipment.

Although research results cannot be predicted on an annual basis, the Program continues to produce impressive results in the form of new scientific information as well as instrumentation and biomedical technologies that will allow researchers to continue to expand our knowledge base. Let me summarize just a few of our recent accomplishments.

At the University of Chicago, researchers have developed a computational approach that can correlate medical images obtained by three techniques--Computer Assisted Tomography (CAT), Positron Emission Tomography (PET), and Magnetic Resonance Imaging (MRI)--and display the combined structural and functional information simultaneously. Because these images are acquired at different times, in different formats, and from different perspectives, they are difficult to compare visually. This technique has already proven useful in evaluating radiation treatment of brain tumors, and is expected to have other diagnostic applications.

Researchers at Lawrence Livermore Laboratory have developed a simple way to assess the cumulative somatic cell genetic damage caused by exposure to ionizing radiation. (Somatic cell mutations, unlike mutations induced in reproductive cells, cannot be transmitted to one's offspring.) By identifying red blood cells that are lacking a specific protein due to mutations caused by exposure to radiation, and counting the mutant cells in small blood samples, scientists are able to estimate the accumulated mutations in the bone marrow of the exposed individuals. Studies of groups of people exposed to ionizing radiation, such as the Hiroshima survivors and the firefighters at Chernobyl, show increased incidences of non-heritable mutations in proportion to the dose of radiation they received. To verify the expectation that these genetic changes will persist through the life of the individual, long-term studies on the exposed individuals are planned in conjunction with the International Atomic Energy Agency.

The importance of DNA repair mechanisms in protecting cells from radiation damage has been dramatically demonstrated by Lawrence Berkeley Laboratory (LBL) scientists. Analysis of research data at LBL revealed that removal of the genes responsible for the DNA repair process from yeast cells leaves those cells 1,000 times more vulnerable to ultraviolet radiation from sun light. Because DNA repair processes in yeast cells are similar to those in human cells, this finding is important for the understanding of skin cancer and other diseases triggered by ultraviolet light, and by other environmental agents such as ionizing radiation and certain chemicals.

New information about the pivotal role played by atmospheric oxidants, such as hydrogen peroxide, in the production of acids in clouds has made an important contribution to the National Acid Precipitation Assessment Program (NAPAP). The work was conducted by researchers at Brookhaven National Laboratory. Hydrogen peroxide promotes a rapid transformation of sulfur dioxide to sulfuric acid. During special weather conditions, primarily during the winter, hydrogen peroxide concentration can be so low that it cannot maintain the production of sulfuric acid over large areas despite the abundance of sulfur dioxide. This has important implications to contemplated emission control strategies as during these low oxidant periods reducing sulfur dioxide emissions will have negligible impacts on sulfuric acid deposition.

With its focus on the earth rather than the atmosphere, exploratory research begun in 1986 on the microbial ecology of the earth's crust has generated international attention in the scientific community and in the private sector. The discovery by scientists at Pacific Northwest Laboratory of diverse microbial communities at depths of nearly 900 feet opened the possibilities for *in situ* cleanup of organic chemical contamination in deep burial sites. During the past year, findings of bacteria with antibiotic resistance raise the possibility of finding other microorganisms producing novel, medically useful compounds.

The FY 1989 budget request for the BER program is $249.0 million. Within this request, $236.5 million is for Operating Expenses, $9.0 million is for Capital Equipment, and $3.5 million is for Construction (Table 20). Funding by research area is shown in Table 21. The base BER program reflects an increase of approximately 15 percent, excluding the FY 1988 Congressionally initiated university construction projects.

Table 20
Energy Supply R&D
Biological and Environmental Research
Budget Authority
($ in millions)

	FY 1987	FY 1988	FY 1989 Request
Operating Expenses	$176.6	$204.6	$236.5
Capital Equipment	8.5	8.5	9.0
Construction	6.0	56.2	3.5
Total	$191.1	$269.3	$249.0

Table 21
Energy Supply R&D
Biological and Environmental Research
Budget Authority
($ in millions)

	FY 1987	FY 1988	FY 1989 Request
Late Effects on Health & Environment of Energy Development and Use			
Source and Dose Determination	$ 13.6	$ 16.0	$ 17.7
Environmental Processes & Effects	31.8	32.4	41.0
Health Effects	59.5	64.2	70.7
General Life Sciences	33.3	39.8	51.0
Nuclear Medicine	21.8	34.2	34.5
Carbon Dioxide Research	13.0	14.0	17.6
Facility Operations	14.5	64.7	12.5
Program Direction	3.6	4.0	4.0
Total	$191.1	$269.3	$249.0

The broad scope of BER's mission can be seen in the several research areas for which funding is requested in FY 1989. Research related to the long-term effects of energy development and use on human health and the environment will be carried out under four research areas: Source and Dose Determination, Environmental Processes and Effects, Health Effects and General Life Sciences. The FY 1989 budget request in these areas will support research and the development of instrumentation to: (1) identify, measure, and characterize energy-related contaminants such as radiation and toxic chemicals; (2) enable us to predict how these materials move through and affect the environment; and (3) understand their potential effects on human health. The FY 1989 request also will support research aimed at adding to our understanding of variations in human susceptibility and resistance to environmentally associated diseases and our ability to predict and modify the possible genetic burden that current policy places on future generations as well as our own.

I would like to highlight some key aspects of the FY 1989 request in the environmental and health research areas I have just mentioned. In the environmental area, the funds requested in FY 1989 will be used to address a variety of issues, including: acid rain, indoor radon, carbon dioxide, global climate change, the resiliency of ecosystems and marine coastal areas to the effects of energy activities, management of radiation and chemical wastes, and atmospheric modeling at different terrains representative of different energy development sites. Among other FY 1989 activities, there will be a substantially increased effort to define the role of microorganisms living in the earth's subsurface in degrading, or breaking down, chemical contaminants so that their harmful effects are reduced or eliminated. This research will have long-term implications for decontamination of deep aquifers.

An ongoing effort to develop critical new information that ultimately can be applied to cost-effective decontamination of DOE wastes and for remedial action will be expanded in FY 1989. The new information gained from this subsurface research will improve our understanding of factors that influence the movement of mixed wastes through soil, thus contributing to safer and more effective operation of shallow, low-level burial sites. This effort will also include the development of accurate, non-invasive and inexpensive techniques and instruments that will eliminate the need for costly well drilling to assess migration of subsurface wastes. Research to determine the movement of contaminants in the subsurface and factors that limit their movement will be emphasized also.

The radon research program, significantly expanded in 1988 in response to increased national concern, will continue in FY 1989. This program, in accordance with a DOE/EPA Memorandum of Understanding, will emphasize the basic scientific research needed to establish risk from exposure to indoor radon. Research will include identification of critical cells in the lung, improved measurement technology, modeling of radon in soils, and interactions between radon and smoking in lung cancer development.

Another important aspect of the FY 1989 request is the Life Sciences research aimed at developing a better understanding of DNA damage and repair mechanisms. An enhanced effort will be applied toward improving the tools and methodology needed for deciphering the human genome, the complete set of genetic instructions present in human cells.

The human genome effort, formally initiated by BER in FY 1987, is being increasingly recognized by the scientific community as modern biology's most significant challenge. Greater understanding is expected to lead to major advances in all aspects of biology and medicine, including the diagnosis, prevention and treatment of the more than 3000 genetically caused diseases. This activity is also expected to provide a major impetus to the Nation's biotechnology industry. The new tools and methodologies to be developed under this initiative will greatly increase the pace and lower the cost of mapping and sequencing the human genome. The proposed level of effort of $18.0 million will help establish the phased, multidisciplinary collaboration necessary among academia, the private sector and the Department's laboratories.

In addition to the four health and environmental research areas I mentioned earlier, the BER program also supports research in Nuclear Medicine and Carbon Dioxide Research. The Nuclear Medicine activity, with an FY 1989 Operating Expenses request of $34.5 million, continues to make it possible to monitor body functions, isolate the causes and extent of diseases and treat these diseases with new and more effective methods. The development and use of new radiopharmaceuticals in metabolic studies, chiefly of the heart and brain, is one major aspect of this activity. Radiopharmaceuticals are radioactive compounds that concentrate in certain body organs and can be followed with sensitive radiation detectors to make the body's internal organs visible to medical diagnosticians. This allows diagnoses to be made without invasive procedures such as biopsy. In FY 1989 this research activity will include an increased effort to explore boron neutron capture therapy as a promising radiation treatment.

Research in Nuclear Medicine also includes clinical feasibility studies which involve in vivo testing of new radiopharmaceuticals in animals and, subsequently, in selected patients, as well as efforts to develop and improve instrumentation for the diagnosis and treatment of disease through nuclear medicine. In addition to research in FY 1989 aimed at improving the resolution of positron emission tomography and other imaging techniques, research on a new portable device for rapid, bedside evaluation of pulmonary edema will be completed. This device will allow water buildup in the lungs to be estimated more accurately than is currently possible. Emphasis will also be placed upon developing monoclonal antibodies for diagnosis and therapy.

The FY 1989 Operating Expenses request for the Carbon Dioxide Research activity is $17.6 million. The goal of this research continues to be to develop sound, quantitative information about atmospheric CO_2 change and its effect on climate, earth resources and energy technologies. We must understand the cause and effect relationships between CO_2 concentrations and global, regional, and seasonal warming before energy policy recommendations can be made.

Carbon dioxide and the greenhouse effect linked to global climate change has become a major national and international science and energy policy issue. The Department's State-of-the-Art Reports, which summarize what we know, show substantial progress but also identify areas where further research is needed to reduce uncertainties. These research needs include a better understanding of how climate is changing and whether those changes are consistent with projections. Substantial improvement also is needed in the way oceans and clouds are portrayed in climate models. A third problem identified by the State-of-the-Art Reports is the need to develop data and evaluate the primary effects of both CO_2 and climate change on biological systems as a whole.

The FY 1989 budget request will support research aimed at improving our knowledge base in each of the above areas. The development of regional resource and analysis techniques will be emphasized as will the efforts aimed at understanding how clouds and oceans affect global exchange and storage of CO_2 and heat. The budget request includes $1.0 million for policy analysis research. This research will investigate the potential reduction in CO_2 emissions that could be achieved through strategic energy planning. It will also identify which geographic regions may be in jeopardy if significant climate changes occur.

The request also includes $2.0 million for research related to the comparison of various predictive climate models and improved data and analysis of clouds and the oceans as they affect and are affected by climate change. The objectives of this research are to: (1) understand the causes and reconcile the disparities among model simulations; (2) provide a comprehensive diagnosis as to needed improvements in the climate models; and (3) identify the uncertainties and limits to the accuracy of seasonal and regional predictions as a means of providing useful data. Results of the leading U.S. and international climate models will be analyzed in cooperation with the research groups developing and applying the models. The international groups include scientists from England, China, Canada, Germany, the Soviet Union and Japan as well as the U.S.

The FY 1989 BER budget request for Facility Operations is $12.5 million. Of this total, $9.0 million is for Capital Equipment and $3.5 million is for General Plant Projects. The Capital Equipment request supports replacement of deteriorated and obsolete equipment at the laboratories as well as acquisition of new, state-of-the-art instruments. General plant projects are necessary to keep the general plant of the laboratories (e.g., buildings, roads and utilities) in good operating condition.

The FY 1989 request for Program Direction is $ 4.0 million. These funds are required to pay for the personnel costs of 55 full-time equivalents to direct, manage and support BER's multidisciplinary research efforts.

At this point, I would like to discuss the several ER programs that are related to my statutory responsibilities to advise the Secretary on DOE's R&D programs, on the non-weapons multiprogram laboratories and on the education and training of scientists and engineers.

ENERGY RESEARCH ANALYSIS

The Energy Research Analysis (ERA) program performs technical assessments and research analyses that cut across all aspects of the Department's civilian R&D programs. These assessments and analyses provide technical support to the Director in carrying out legislatively assigned R&D oversight responsibilities. The ERA program focuses in depth on particular project or program areas and offers an independent view of how well research is conducted and where the most promising opportunities for future research lie. The program also plays a key role in coordinating the Department's involvement in acid rain research. Specifically, the program provides DOE'S share of the financial support for management of the National Acid Precipitation Assessment Program (NAPAP). In addition to providing funds, this program represents DOE on technical task groups and reviews documents produced by NAPAP and non-Federal groups for their scientific quality and objectivity.

The FY 1989 budget request of $3.8 million will provide continued funding for assessments of ongoing research on membrane separations technology, laser instrumentation and analytical chemistry of air pollution. In addition, analyses critical to the successful completion of the final National Acid Precipitation Assessment Program in 1990 will be conducted.

UNIVERSITY RESEARCH SUPPORT

The Department encourages universities and colleges to contribute to the national energy R&D effort, for these universities produce much of the new scientific knowledge and technical talent that ultimately enters the marketplace and contributes to the Nation's continued economic and social progress. University scientists and students conduct research sponsored by

DOE in all areas of fundamental science and energy R&D. This support includes both direct awards for on-campus research and collaborative efforts involving DOE laboratory scientists and facilities. The Department also supports the involvement of faculty and students in two specific research and science education-related programs, the University Research Support (URS) Program and the related University Research Instrumentation Program, which I will discuss next.

The major objectives of the URS program are to: (1) strengthen university capabilities to perform long-range R&D; (2) enhance the quality and increase the numbers of young people pursuing energy-related R&D careers; (3) use the unique resources of the Department's laboratories both for university faculty and student research and training; and (4) enhance technology transfer to the private sector, thus assisting in the national effort to revitalize the Nation's economic position in the world marketplace.

The URS program, with an FY 1989 budget request of $15.8 million, consists of four activities: Laboratory Cooperative Science Centers, R&D Laboratory Technology Transfer, University Reactor Fuel Assistance, and Energy Manpower Development (Table 22).

The largest of the URS programs, with a request of $9.5 million, is the Laboratory Cooperative Science Centers. The essential roles played by the Department's laboratories in assisting university research and manpower development have been underscored in recent Energy Research Advisory Board and White House Science Council reports on the health of U.S. colleges, universities and industry. Consistent with these analyses and the President's goal of improving our national science and technology research and education base, an initiative was begun in FY 1988 to broaden and strengthen the Laboratory Cooperative Science Centers. This Program provides support for over 2100 summer research/instructional appointments at the DOE laboratories for university faculty and students. In addition, a new semester-length research program was initiated at five DOE multiprogram laboratories. Three hundred undergraduate science and engineering students were selected in a

Table 22
Energy Supply R&D
University Research Support
Budget Authority
($ in millions)

	FY 1987	FY 1988	FY 1989 Request
Operating Expenses			
Laboratory Cooperative Science Centers	$ 9.9	$13.8	$ 9.5
R&D Laboratory Technology Transfer	0.8	1.0	1.4
University Reactor Fuel Assistance	3.8	1.9	2.1
Energy Manpower Development			
Energy Manpower Assessment	0.5	0.5	0.6
Energy Education and Training	0.6	1.2	2.2
Total URS	$15.6	$18.4	$15.8

national competition. In FY 1989, support will be expanded to provide for 450 undergraduate science and engineering students and 36 faculty/student research teams to participate in the program at six labs. This expanded effort provides a year round focus for students and faculty research and education efforts.

In FY 1989 the R&D Laboratory Technology Transfer activity will provide joint support to 30 industry scientists and engineers to work on research assignments at national laboratories side-by-side with DOE's scientists, with the objective of transferring federally supported expertise to the private sector for commercial application. These assignments are cost shared with industry and involve both large and small companies. Support will also be provided for pilot laboratory initiatives to improve spin-off of federally funded R&D to U.S. industry.

The University Reactor Fuel Assistance activity provides support for refueling and related activities for university nuclear research and training reactors. The FY 1989 budget request will provide for refueling four reactors and will fund 23 reactor sharing research awards involving scientists from more than 50 universities. The request will also continue support for low-enriched uranium reactor fuel conversion as required by the Nuclear Regulatory Commission.

This activity will be approximately at its midpoint by FY 1989 with 12 university reactors having received support for their reactor safety studies and four having received Commission approval for fuel conversion and startup.

The goal of the Energy Manpower Development activity is to increase the number of young people pursuing energy-related scientific and technical careers. The FY 1989 budget request will expand support for precollege science student and teacher programs sponsored by the laboratories. Six high school science student honors programs will be supported in FY 1989 at the Lawrence Livermore, Brookhaven, Lawrence Berkeley, and Oak Ridge National Laboratories, Fermi National Accelerator Laboratory, and the Pacific Northwest Laboratory. Over 2100 minority and female junior high school students will be supported through university grants under the Pre-Freshman Engineering program.

UNIVERSITY RESEARCH INSTRUMENTATION

The goal of this annual, competitive program is to strengthen the ability of universities to conduct long-range research on selected energy problems and processes by helping them to acquire the required state-of-the-art instrumentation. Another objective is to provide graduate students with hands-on experience in the use of sophisticated research equipment.

The University Research Instrumentation (URI) program, with a budget request of $5.0 million for FY 1989, complements the Department's energy research and technology programs. Generally, research grants and contracts provide support only for research operating costs, with funding for new equipment limited to instruments costing less than $30,000. The URI program assists universities in purchasing instruments costing over $100,000 that will be used by a number of researchers, including students.

Each year, the Department's program managers help select the high priority energy topic areas that are to be emphasized in the URI program announcement. The annual awards are based on merit, the accomplishments of current DOE-supported research projects, and the degree to which the new equipment will enable researchers to substantially advance the understanding of energy-related phenomena. Since FY 1986, the URI program has emphasized support for innovative instrumentation, that is, equipment not generally available at U.S. universities. The FY 1989 request will continue this emphasis and will support about 18-20 instrumentation awards.

MULTIPROGRAM ENERGY LABORATORIES-FACILITIES SUPPORT

The Multiprogram Energy Laboratories-Facilities Support (MEL-FS) program aims to reduce deficiencies and to maintain safe, cost-effective and productive operations at the five national laboratories overseen by the Office of Energy Research. This is accomplished by supporting activities that counter problems of aging and obsolescence of facilities and of environmental compliance.

The FY 1989 budget request for MEL-FS is $65.9 million. Of that amount, $41.4 million is for the General Purpose Facilities Construction subprogram and $24.5 million is for the ORNL Environmental Compliance subprogram (Table 23).

The General Purpose Facilities Construction subprogram provides for rehabilitation and upgrading of deficient buildings, utilities, roads and other necessary facilities at the laboratories supported by the Office of Energy Research. The highest priority projects are those that address urgent

Table 23
Energy Supply R&D
Multiprogram Energy Laboratories - Facilities Support
Budget Authority
($ in millions)

	FY 1987	FY 1988	FY 1989 Request
General Purpose Facilities Construction			
Ongoing Projects	$ 23.7	$ 22.7	$ 29.8
New Projects	7.7	5.8	11.6
Total General Purpose Facilities	$ 31.4	$ 28.5	$41.4
Environmental Compliance-ORNL			
Operating Expenses	14.3	12.9	8.8
Capital Equipment	1.0	0.4	0.3
Construction	10.0	11.8	15.4
Total Environmental Compliance	$ 25.3	$ 25.1	$ 24.5
Total Multiprogram Energy Laboratories-Facilities Support	$ 56.7	$ 53.6	$ 65.9

environmental, health and safety deficiencies and those that can hamper or interrupt operations. The Construction request for this subprogram will continue 19 ongoing projects and initiate 14 new projects. The new projects include 2 environmental related projects, 1 road safety project, 2 fire protection projects, 3 utility projects and 6 building rehabilitation or replacement projects.

The ORNL Environmental Compliance subprogram originated in 1985 to address non-defense environmental deficiencies at Oak Ridge National Laboratory. This program will bring all operational systems up to current and expected environmental standards and will perform remedial actions necessary to clean up environmentally contaminated areas that are related to past ER activities.

Of the total $24.5 million Environmental Compliance request, $8.8 million is for Operating Expenses. This request will provide for assessments of the condition of operating systems and development of plans for needed upgrades. The Capital Equipment request of $0.3 million will provide equipment needed to support cleanup activities. The $15.4 million Construction request will provide funds to continue two high priority construction projects related to the liquid waste systems at ORNL.

ADVISORY AND OVERSIGHT PROGRAM DIRECTION AND POLICY AND MANAGEMENT

The FY 1989 budget request for Advisory and Oversight Program Direction is $3.3 million. The FY 1989 request will provide the staffing resources required by the Director of Energy Research to carry out his responsibilities under legislation (P.L. 95-91) and those assigned or delegated by the Secretary in areas beyond the scope of other ongoing Energy Research programs. These funds are required to provide for the salaries, benefits, travel and other expenses associated with 44 full-time equivalents.

The FY 1989 budget request for Policy and Management is $0.7 million. These funds are required to provide for the salaries and related expenses associated with 8 full-time equivalents in the Office of the Director of Energy Research. That concludes my statement. I would be happy to answer questions.

BIOGRAPHICAL SKETCH

JAMES F. DECKER

Dr. James F. Decker is the Acting Director, Office of Energy Research in the U.S. Department of Energy (DOE). In addition, Dr. Decker also serves as the Deputy Director, Office of Energy Research (OER). OER supports all of the basic research in DOE through the following programs: High Energy and Nuclear Physics, Basic Energy Sciences, Health and Environmental Research, Magnetic Fusion Energy and the Scientific Computing Staff. OER is one of the largest basic research activities in the Federal government. Research is funded in DOE laboratories, universities and industry.

Previously, Dr. Decker concurrently served as a Special Assistant to the Director of OER and as Director of the Scientific Computing Staff. In that capacity, he was responsible for: (1) solving the supercomputer access problem for the research programs supported by the OER; (2) advising the Director of OER and the research programs in OER on international affairs; and (3) making policy recommendations for improving technology transfer from the DOE laboratories to U.S. industry. Dr. Decker also served as chairman of two interagency working groups convened by the White House Science Office to develop recommendations for federal policy on supercomputers.

In 1973, Dr. Decker joined the Atomic Energy Commission (a DOE predecessor agency) in what is now the Magnetic Fusion Energy program. He held positions of increasing responsibility and subsequently served as Branch Chief, Experimental Plasma Research and Director, Division of Applied Physics. As Director, he was responsible for all theoretical fusion research, basic experimental plasma physics research, the Magnetic Fusion Energy Computer Network, and evaluation of novel fusion concepts.

Before joining the Federal government, Dr. Decker was employed at the Bell Telephone Laboratories where he conducted research in plasma physics and worked on ion implantation for integrated circuit development.

Dr. Decker received his B.S. degree from Union College in 1962, his M.A. degree and Ph.D. from Yale University in 1963 and 1967, respectively. He has received several awards from DOE and serves on a number of advisory committees within the Federal government.

A native of Albany, New York, Dr. Decker is married and has two children.

June 1987

ENVIRONMENT, SAFETY AND HEALTH

STATEMENT OF GARRY W. GIBBS, ACTING ASSISTANT SECRETARY, ENVIRONMENT, SAFETY AND HEALTH

Senator JOHNSTON. Mr. Gibbs, you may proceed.

Mr. GIBBS. Mr. Chairman, I am pleased to be here today to discuss with you the Department of Energy's budget request for fiscal year 1989 for the Environment, Safety and Health Program.

I have submitted a written statement for the record and wish to briefly, with your permission, highlight several of the Department's initiatives and progress since we last appeared before this committee.

Since the Secretary established an Environment, Safety and Health Initiatives [ES&H] Program in 1985, the Department of Energy has undergone a significant transition in its approach to implementing and overseeing the safety and environmentally sound operations at its facilities.

Events during this time have further demonstrated the need for a strong Environment, Safety and Health Program if the Department is to continue to meet its national energy and security missions. Chief among these events was the Chernobyl accident in 1986, followed by the Secretary asking the National Academies of Science and Engineering to augment ongoing Department safety reviews and to provide an independent assessment of safety and technical issues at the Department's 11 class A nuclear reactors.

NUCLEAR WEAPON PRODUCTION COMPLEX ISSUES

In October 1987, the Academies completed their report on four of the production reactors for the Department. The Secretary immediately directed the Department to take action to respond to the safety recommendations, including the establishment of an independent, external advisory committee on nuclear facility safety.

This committee has since been established and is composed of recognized experts with broad technical experience and affiliations, and reports directly to the Secretary. With John Ahearne, a former NRC Chairman, at its head, this committee will provide independent advice to the Secretary and will be a valuable complement to the internal Department oversight provided by my Office.

This approach was recommended by the Academies and will achieve the broad objectives of various legislative proposals now pending before Congress. The committee will convene its first meeting on March 29 and will initiate what should be a very productive safety agenda.

Further actions were also called for in the Academies' recommendations and I can report to you today that the Department is responding with steps that not only address the technical concerns and safety issues, but also necessary institutional changes. Let me enumerate:

First, we are establishing an on-site headquarters environment, safety and health presence in the field. Savannah River and Rocky Flats have received immediate attention with ES&H personnel established on-site earlier this month, and additional sites are under consideration.

Second, we are restructuring and expanding the headquarters safety organization to provide an improved focus and strengthened departmental safety oversight function.

Third, we have executed an agreement with the Institute for Nuclear Power Operations [INPO] to put the Department more into the mainstream of commercial nuclear industry safety practices.

Fourth, we are initiating a contractor self-improvement program to additionally focus on safety improvements at the operating contractor level where the work is performed.

Fifth, we are revamping the process by which the environment, safety and health orders are developed, coordinated, and issued so that safety guidance can be provided to the field and implemented quickly.

Other steps are also being taken to respond to the Academies' recommendations regarding a well-founded Department safety framework with clear safety objectives and orders.

Additional specific technical issues raised by the Academies for both the N Reactor at Hanford and the Savannah River reactors are being addressed by a Department action plan, which includes full treatment of severe accident considerations, accelerated application of probabilistic risk assessments, and a reevaluation of operator procedures, practices, and training.

STATUS OF ONGOING ACTIVITIES

Let me now turn briefly to the progress the Department is making on the balance of its ongoing environment, safety and health activities.

First, the environmental survey program, which is designed to identify problems and to prioritize them for corrective action, is proceeding on schedule. Survey work is being completed at 26 of the 37 Department sites, with the balance of the surveys to be conducted during fiscal year 1988 and completed during fiscal year 1989.

Second, the technical safety appraisals of the Department's nuclear facilities are also progressing well, with appraisals completed at 21 of 52 facilities. Safety appraisals for the remaining facilities will be completed by fiscal year 1989.

Both of those activities, the environmental survey and the technical safety appraisals, have been structured to provide the Department, for the first time, with a baseline of requirements against which the Department can prioritize and manage its resources Department-wide for corrective actions.

Further, the Department has executed 28 federal facility compliance agreements with the States and/or the Environmental Protection Agency to resolve existing compliance problems.

Finally, a new mixed waste rule has been adopted by the Department that subjects all radioactive waste containing chemically hazardous components to the EPA and state regulation under the Resource Conservation and Recovery Act [RCRA].

BUDGET REQUEST

Let me briefly just summarize the Department's fiscal year 1989 budget request.

Although we have made substantial progress, much more needs to be done to continue the initiatives discussed before and to extend the gains that the Department has made. The fiscal year 1989 budget asks for a $42 million increase in resources—$110 million versus $68 million in fiscal year 1988—and an addition of 10 FTE's.

The largest increase is allocated to the Nuclear Safety Program in response to the National Academies of Sciences and Engineering recommendations, with $22.9 million in that area, and a relatively large increase for the safety policy development area of $10.9 million.

These funding increases will enable us to conduct activities we have committed ourselves to relative to the Academies' recommendations, as well as addressing problems that we have identified by virtue of our ongoing technical safety appraisals and other reviews.

Highlights of the budget request include more frequent safety appraisals, both for class A and class B reactors, as well as high to moderate hazardous nuclear facilities, an increased number of design reviews, assessment of field safety performance on an annual basis, more intensive appraisal followup, improved reviews of safety analysis reports, and contractor self-improvement.

In the environmental arena, a major milestone will be achieved with the completion of the environmental survey program, which will be followed by a program of regular environmental audits to ensure compliance, increased NEPA review and appraisal activities, and a greater emphasis on environmental guidance development and compliance support.

In summary, these activities and requested resources are considered essential to bringing the Department's facilities into compliance and to ensure environmentally sound operations. The safety initiatives are commensurate with the Department's commitment to operate our facilities in a safe manner, with concern for public health and worker safety.

PREPARED STATEMENT

This completes my statement, and I look forward to answering any questions.

[The statement follows:]

STATEMENT OF GARRY W. GIBBS, ACTING ASSISTANT SECRETARY, ENVIRONMENT, SAFETY AND HEALTH

Mr. Chairman and Members of the Subcommittee, I am pleased to be here today to discuss with you the Department's budget request for FY 1989 for the Environment, Safety and Health program.

GOALS OF THE OFFICE OF ENVIRONMENT, SAFETY AND HEALTH

It is the policy of the Secretary of Energy to conduct all of the Department's operations in a safe and environmentally sound manner. Protection of the environment, our workers and the public are of paramount concern and importance to the Department.

Since the establishment of a Secretarial initiatives program in 1985, the DOE environment, safety and health oversight program has undergone a significant transition. It has developed into a fundamentally sounder and stronger program than it was in the past. Initiatives are underway in the environment, safety and health area to further develop and strengthen the oversight program.

The goals of the Environment, Safety and Health program are to:

- Provide clear guidance on environment, safety, health and quality assurance policy, standards and compliance requirements.

- **Assure, through strengthened oversight, conformance of DOE activities with applicable environment, health and safety policies, standards, laws and regulations.**

- Foster a commitment to excellence in all facets of DOE operations that affect the environment, health and safety.

- Provide liaison with other Federal agencies, such as the Environmental Protection Agency and the Nuclear Regulatory Commission, concerning specific regulatory actions of those agencies that may have an impact on DOE facilities and operations.

- Assure that national environmental protection goals are incorporated into the formulation and implementation of energy programs and policy.

- Analyze national environmental policy and regulations and their affect on energy supply and demand, and the energy industry.

Secretary Herrington's commitment to a strengthened environment, safety and health program has led to dramatic improvements in how DOE conducts its business. Since the announcement of the Environment, Safety and Health initiatives in 1985, the strengthening of the Office of Environment, Safety and Health has been progressing steadily. From 1985 to 1988, the budget of this office increased by 79% and the staffing increased by 72%. The department-wide Technical Safety Appraisals and the Environmental Survey that were initiated in 1985 are also progressing as planned.

Technical Safety Appraisals are on-the-spot appraisals of DOE's major nuclear facilities to determine compliance with safety requirements and to assure proper application of DOE's safety requirements, lessons learned in the nuclear industry and appropriate licensed facility requirements. The Environmental

Survey is an inventory of existing environmental problems and an identification of potential areas of risk at DOE facilities.

These initiatives, when completed, will establish for the first time in DOE's history a Department-wide baseline of environmental and safety information about its facilities and operations. As of February 1, 1988, 21 of 52 Technical Safety Appraisals have been completed, and 26 of 37 sites have been surveyed, with priority given in both programs to the key defense facilities which are critical both from the environmental, safety and health standpoint and for the Department's national security mission. Priorities for immediate and for longer-range action will be based on the information from these efforts.

During 1986, the Department, for the first time, issued an Environmental Policy Statement and a Safety and Health Policy Statement, stressing the Secretary's personal commitment to ensuring safe and environmentally sound operations, and reinforcing the environment, safety and health responsibilities of line managers and personnel at all levels of the Department. Safety Orders were revised, strengthened and reissued to enhance the oversight role of the Office of Environment, Safety and Health including for the first time, delegated facility shutdown authority.

In October 1987, the National Academy of Sciences and the National Academy of Engineering (NAS) issued their report, "Safety Issues at the Defense Production Reactors," on the safety of the Department's production reactors. This report, which was requested by the Secretary, assessed safety issues that have concerned the Department for the past 3 years -- issues such as the quality and strength of the internal safety oversight system, the need for supplemental external oversight, the adequacy of technical safety standards, and the need for modernization and upgrading of DOE's aging nuclear weapons complex.

In its report NAS recommended, among other measures, that the Department establish an independent external safety oversight committee to advise the Secretary of Energy, similar to the Nuclear Regulatory Commission's Advisory Committee on Reactor Safeguards for commercial nuclear power plants. The Secretary acted immediately on this recommendation by establishing, pursuant to the Federal Advisory Committee Act, the Advisory Committee on Nuclear Facility Safety. Composed of recognized experts with broad technical experience and affiliations, the Committee reports directly to the Secretary under a charter consistent with the criteria cited by NAS and similar in operation to the Advisory Committee on Reactor Safeguards. The Committee will provide independent technical advice on topics it deems to have safety significance to assist the Secretary in carrying out his statutory responsibility for safe operation of DOE nuclear facilities. The Committee has broad authority to review Departmental activities at the production reactors, including design reviews, safety analyses, operations, management, inspection and enforcement. The expertise and independent judgement of the committee will be a valuable supplement to the Department's internal oversight already provided by the Office of Environment, Safety and Health.

To further strengthen its internal oversight and technical capabilities, the headquarters safety organization is being restructured to provide improved organizational focus on safety appraisals, compliance issues, quality assurance, and safety standards development. Key functions that will be introduced include routine DOE-wide evaluation of field safety performance, centralized follow-up and verification of compliance, and an in-house technology-based group to address complex technical safety issues in nuclear facility design and operations. On-site resident safety staff reporting to headquarters will be placed at designated critical sites; Savannah River Plant and Rocky Flats are receiving immediate attention. The initial contingent of on-site safety personnel has been established at these sites and additional sites are being considered. Resident personnel will monitor and inspect operations and will serve to provide independent and timely information directly to headquarters.

In response to the NAS's recommendations for DOE to put itself more into the mainstream of industry safety practices, DOE has executed an agreement with the Institute of Nuclear Power Operations (INPO) that will provide access to current industry data and for INPO technical assistance. As a means to complement the INPO agreement and to enhance contractor technical capabilities, the Department is also initiating a contractor self-improvement program. Key elements of this program will include operator training accreditation, technical interchange on operating standards and experience, and development of recommended safety practices.

To assure clearer and more timely safety policies and standards, the process by which Departmental Environmental, Safety and Health Orders are developed, coordinated, and issued has been changed. The new procedures provide greater independence and control to the Office of Environment, Safety and Health in developing environment and safety requirements, and will result in more efficient and timely issuance of Orders.

PLANNED FY 1988 ACCOMPLISHMENTS

In FY 1988, the Environment, Safety and Health program is giving top priority to the implementation of the recommendations contained in the NAS report, and to continuing efforts toward completing the initiatives announced by the Secretary in 1985.

- Implementation of NAS recommendations:
  - Established the Advisory Committee on Nuclear Facility Safety, and initiated Committee functions.
  - Accelerated the ongoing expansion of the headquarters safety function. Increased manpower resources by 34 FTEs.
  - Restructured the headquarters safety organization to provide improved organizational focus on safety appraisals, compliance issues, quality assurance, and safety standards development.
  - Established resident inspectors at critical nuclear facility sites, with plans to expand to other sites.
  - Executed an agreement with the Institute of Nuclear Power Operations (INPO) that provides access to current industry data and to INPO technical assistance resources.
  - Initiated a technical review to develop and establish clear DOE safety objectives that will apply to nuclear production reactors, and to a broader range of DOE nuclear facilities.
  - Implemented key safety policy initiatives in the areas of severe accident analysis, use of probabilistic risk assessments, nuclear facility backfits and facility design criteria.

- Accelerated the assessment of the completeness and adequacy of existing DOE Safety Orders.

- Instituted a new process by which Environment, Safety and Health Orders are developed, coordinated, and issued, to promote timeliness, efficiency and quality.

Secretarial Initiatives Program and Related Activity:

- Completed on-site Environmental Survey activities at 16 DOE sites; initiated and completed the field sampling effort at 11 sites.

- Continued the nuclear safety appraisal program, including 17 Technical Safety Appraisals and 3 nuclear safety program appraisals, and followed-up on FY 1986 and FY 1987 appraisals.

- Compiled and prioritized DOE environmental problems to serve as a basis for developing a long-range plan for corrective actions across the production complex by July 1988 and expanding to a Department-wide plan by December 1988.

- Continued efforts to establish Federal Facility Compliance Agreements at 10 sites.

- Continued performance of technical evaluations of safety analysis reports for high-hazard and selected moderate-hazard nuclear facilities.

- Expanded guidance and oversight activities dictated by the October 1987 passage of the Superfund Amendments and Reauthorization Act (SARA), and by application of the Resource Conservation and Recovery Act (RCRA) to DOE radioactive mixed-wastes.

- Completed an estimated 140-160 reviews of Environmental Assessments and Environmental Impact Statements and 180-200 other NEPA related actions.

- Participated in multilateral and bilateral transboundary air pollution negotiations and consultations.

FY 1989 FUNDING

Significant progress has been achieved over the past 3 years in strengthening the Department's Environment, Safety and Health program. The NAS report suggests that more needs to be done. The Department is committed to vigorously pursuing steps to produce a credible oversight program, responsive to the NAS recommendations.

The FY 1989 budget request for the Environment, Safety and Health program is $110.0 million, an increase of $42.0 million above the FY 1988 appropriation of $68 million.

Program increases are primarily allocated to 5 areas: support for the implementation of the recommendations contained in the NAS report including staff and support costs for the Advisory Committee on Nuclear Facility Safety; increased technical support for the development and issuance of safety, health and quality assurance policy guidance; expansion of oversight activities to ensure that nuclear facilities and DOE operations are operated safely and in compliance with DOE policy and applicable standards; increased NEPA support for major and highly complex programs, including the Superconducting Super Collider, Clean Coal Technology, the New Production Reactor programs and implementation of a comprehensive NEPA compliance appraisal program; and, increased technical support necessary to review and implement new environmental regulations.

The following is a summary of our FY 1989 Budget Request:

FUNDING SUMMARY
(Budget Authority in Millions)
Environment, Safety and Health

Program	FY 1988 Approp.	FY 1989 Request	Difference
Environmental Audit	$26.0	$17.0	-$9.0
Envir. Guidance & Compl.	2.3	5.3	3.0
NEPA Project Assistance	1.0	2.9	1.9
Environmental Analysis	2.7	3.0	0.3
Nuclear Safety	18.1	41.0	22.9
Quality Assurance	0.8	1.8	1.0
Operational Safety	3.9	6.0	2.1
Safety Policy	1.1	12.0	10.9
Advisory Committee on Nuclear Facility Safety	--	3.0	3.0
Program Direction	10.0	14.9	4.9
Capital Equipment	2.1	3.1	1.0
Total	$68.0	$110.0	$42.0
Staffing (FTEs) 1/	172	182	10

1/ Does not include FTEs assigned to the NEPA and Environmental Analysis functions that are budgeted under the Nuclear Waste Fund, and Clean Coal Technology Programs.

FY 1989 BUDGET OVERVIEW

Environmental Audit: The goal of the Environmental Audit Program is to provide comprehensive, independent, Headquarters oversight of the Department's operating facilities to ensure compliance with all applicable environmental requirements and to reduce areas of existing or potential environmental risk. This goal is accomplished through a number of activities which include the baseline Environmental Survey characterizing current and potential hazards at major DOE operating facilities and a comprehensive system of planned and periodic audits of DOE operating facilities to monitor improvements and identify new problems. In FY 1989, the Environmental Survey will be completed. The Environmental Audit program will be initiated with 10 audits to be completed in FY 1989 and 20 audits per year thereafter. With the completion of the Environmental Survey, this program will be decreased by $9.0 million in FY 1989.

Environmental Guidance and Compliance: The Environmental Guidance and Compliance function provides environmental policy and technical guidance to Field Organizations with respect to implementation of applicable requirements, and provides oversight and coordination of compliance activities. Demands on this program are increasing in consequence of the passage of SARA and the growing number of environmental issues that must be coordinated in the light of EPA and State efforts to obtain compliance at DOE and other Federal facilities. For FY 1989, specific goals have been established for the program: continue efforts to move the SARA program into the site characterization phase; complete the transition of DOE radioactive mixed-waste facilities into a RCRA regulatory phase; negotiate Federal Facility Compliance Agreements for all DOE Atomic Energy Defense production sites; assure appropriate response actions are taken on the findings of the Environmental Survey, and implement a DOE groundwater and soil protection strategy for the Department. To meet the foreseen greater demand on this program, a $3.0M increase is requested for FY 1989.

NEPA Project Assistance: The NEPA Project Assistance program performs ongoing National Environmental Policy Act functions including project review and technical assistance. About 140 reviews of EISs and EAs and 180-200 other NEPA related actions will be concluded. In FY 1989, an increase of $1.9 million is requested for this program for technical review and support to several major projects: the Superconducting Super Collider, the Clean Coal Technology program, the New Production Reactor program, Defense Program modernization and waste management projects, and for implementing a NEPA compliance appraisal program.

Environmental Analysis: The Environmental Analysis program provides responsive analyses and options development with respect to significant environmental issues that affect national energy supply, demand and prices. In FY 1989, the program will continue to evaluate the energy industries' impact on the environment emphasizing air quality and waste disposal. A $0.3 million increase is requested in FY 1989 for increased support of international programs that are concerned with energy/environmental global and transboundary issues including ozone and climatic change analysis.

Nuclear Safety: The Nuclear Safety program provides independent safety reviews of operations and new projects at the Department's nuclear facilities. The objective of the Nuclear Safety program is to ensure that nuclear facilities of the Department are operated safely and in compliance with DOE policy and applicable standards. The Nuclear Safety program includes: appraisal and audit activity; technical review and evaluation of safety analysis reports and probabilistic risk assessment studies; analysis of experience in the commercial nuclear sector; analysis of technical safety reviews supporting standards development, facility design and operation; a criticality safety evaluation and information transfer activity; an operator training support program; an emergency planning and preparedness activity, and a worker radiation safety program.

Information received during the past two years, particularly in light of the Chernobyl incident, the NAS and other independent oversight studies, the Technical Safety Appraisals, and facility design reviews, have brought into sharp focus a need for a much strengthened and broadened nuclear facility safety oversight activity. A major increase of $22.855 million is being requested for this program in FY 1989. The bulk of this increase is being allocated to the appraisal, audit, technical analysis and review, and operator training activities.

An intensified safety appraisal program will be implemented, including: comprehensive safety reviews of Class A and Class B reactors and moderate hazard non-reactor nuclear facilities; single-topic audits of selected facilities and sites; and comprehensive and aggressive oversight and follow-up of the corrective action programs at the sites. In addition, full-scope reviews of safety analyses will be performed for new reactors and high-hazard non-reactor facilities. We will also conduct annual on-site audits of all Field Office performed safety analyses. Under the cooperative agreement with INPO, efforts will continue toward development of personnel selection, qualification and training program requirements.

Quality Assurance: In FY 1989 the Quality Assurance program will undertake new and expanded activities as part of our overall goal to strengthen safety oversight. The Quality Assurance appraisal program will involve more comprehensive appraisals and reviews of DOE operations, and will establish the capability to perform special verifications, such as reactor safety reliability, in response to specific safety concerns. A $1.0 million increase is requested for this program in FY 1989.

Operational Safety: The Operational Safety program provides occupational safety and health oversight of all Department-owned, contractor operated (GOCO) facilities to assure that employees and property are protected against safety and health hazards. In

FY 1989, a $2.1 million increase is requested for this program to: enable more frequent operational safety appraisals and surveys; initiate operational safety reviews of safety analysis reports; develop guidance and standards: and support the Departmental Personnel Security Assurance programs.

Safety Policy: The Safety Policy program provides the Department a central point for the development of safety, health, and quality assurance policy and the resolution of safety, health and quality assurance issues applicable to DOE operations. The Safety Policy activity assures that DOE nuclear facilities and reactors are sited, designed, constructed, modified, operated, maintained, and decommissioned in accordance with uniform standards, guides, and codes that are consistent with accepted practice as determined by national or international standards and requirements applied to comparable licensed facilities.

In FY 1989, the office will address fundamental safety policy needs, including analysis of existing safety standards and their implementation and development and issuance of new, high priority policies and standards. The need to reevaluate, clarify, and revise the Department's overall safety objectives and policies was a major recommendation of the NAS report. In FY 1989, a $10.9 million increase is requested for this program. Emphasis will be given to examining Safety Orders and policies in light of the NAS support; issue new Safety Orders as appropriate, development of safety objectives for program operations; and development of policies and guidance with respect to probabilistic risk assessment, backfits, severe accident analysis, emergency planning, facility design criteria and human factors. In addition, a policy for a DOE performance assessment system will be issued comparable to the Nuclear Regulatory Commission's, Safety Assessment of Licensee Performance (SALP) program.

Advisory Committee on Nuclear Facility Safety: The Advisory Committee on Nuclear Facility Safety has been established in response to the NAS recommendation for an external advisory oversight group. This Committee is an independent, external oversight committee for nuclear safety and reports directly to the Secretary. The Committee is comprised of recognized experts from outside DOE, appointed by the Secretary of Energy under the Federal Advisory Committee Act. The Committee provides technical advice to assist the Secretary in carrying out statutory responsibilities for safe operation of DOE facilities. The FY 1989 request for this function is $3.0 million. This support level is comparable to resources currently supporting the NRC sponsored Advisory Committee on Reactor Safety.

Program Direction: This function covers staff salaries, travel, training and related employee benefits. It also includes continuing support to the Computer Assisted Tracking System, a FY 1985 Secretarial initiative, and contractor technical support.

In FY 1989, $14.9 million is requested for Program direction. Of this request $8.3 million provides salaries for 182 FTEs; $4.4 million covers costs of benefits, travel, training, awards, and support to the Computer Assisted Tracking System; $2.2 million is allocated to other contract support.

Capital Equipment: Capital equipment funds are requested to support the Emergency Response System, the Computer Assisted Tracking System, the Safety and Health Performance Measurement System, and the Health Physics program. An increase of $1.0 million is requested to enhance the Aerial Measurement System computer and data handling equipment, and to replace obsolete equipment supporting the Radiological Assistance Program and Atmospheric Release Advisory Capability.

This concludes by prepared statement. I would be pleased to answer any questions from the Committee.

BIOGRAPHICAL SKETCH

GARRY W. GIBBS

Garry W. Gibbs was designated Acting Assistant Secretary for Environment, Safety and Health, U.S. Department of Energy (DOE) in January 1988.

In this position, Mr. Gibbs manages the Department's environmental and safety guidance, compliance and oversight functions. His responsibilities include oversight of over 260 nuclear facilities and 160 non-nuclear facilities. He also develops the DOE's environmental and safety policies and standards and assists the Department's field operations and programs in the areas of new project review, liaison with states and federal agencies, technical expertise and compliance.

Previously, Mr. Gibbs served as Principal Deputy Assistant Secretary for Environment, Safety and Health. Before that, he served for 2 1/2 years as Special Assistant for Defense Programs to the Under Secretary of Energy. He joined the Department in 1980 and held increasingly senior positions of technical management and technology development, notably as Laser Program Manager for the Defense Programs Inertial Fusion Program.

In 1967, Mr. Gibbs joined the Department of the Navy and spent 10 years at a Navy field test and evaluation center in Point Mugu, California, where he was responsible for the technical direction and management of missile and laser test and evaluation activities. In 1977 he came to the Naval Sea Systems Command in Washington, D.C., where he directed the analyses of weapons applications for High Energy Lasers.

Mr. Gibbs received his B.S. and M.S. degrees in physics from the University of North Dakota and an M.S. degree in systems management from the University of Southern California. He is also a graduate "With Highest Distinction" from the U.S. Naval War College. Mr. Gibbs has numerous technical publications on laser technology and applications. He received an invention disclosure award for an explosive driven gas dynamic laser. He is listed in Who's Who in Technology Today, 1984. He has also been a member of numerous technical and scientific groups.

February 1988

STATEMENT OF J. ALLEN WAMPLER, ASSISTANT SECRETARY FOR FOSSIL ENERGY

Mr. Chairman and Members of the Subcommittee:

As part of its fiscal year 1989 budget proposal for Fossil Energy-related programs, the Department of Energy is requesting $0.766 million for the Liquefied Gaseous Fuels Spill Test Facility program. The facility serves as a "test bed" for both industry and government in developing safety and environmental control information on the potential hazards of liquefied gaseous fuels and other toxic liquids should they be accidentally released during commercial transport, manufacturing, or storage.

Construction of the $7.9 million facility began in June 1984. Located on an isolated section of the Frenchman Flat Basin in the southeast corner of the Nevada Test Site, the facility was completed in December 1985 and underwent a series of rigorous check-out tests to ensure that all equipment and instrumentation functioned properly. The test "window"--a time when actual spills can be conducted as dictated by local weather patterns--opens in April and extends through September of each year. This allows for the conduct of two to three series of tests, each series consisting of four to six spill tests. The facility was utilized by the private sector during calendar years 1986 and 1987. Commercial user fees cover actual costs of the tests plus any clean up necessary to prepare the facility for the next user.

FACILITY DESCRIPTION:

The facility consists of a control building housing data acquisition and recording instruments, a command and control computer, and a tank farm and spill area. The tank farm includes the following: (1) a spherical-shaped, 8,000-gallon tank to house liquid nitrogen, (2) a nitrogen vaporizer to convert liquid nitrogen to a drive and control gas, (3) pressure vessels to store the nitrogen gas, (4) a 24,000-gallon tank to store noncryogenic fluids for spill tests, (5) two 26,000-gallon dewars for storage of cryogenic test fluids, and (6) two 12-inch diameter insulated lines and one 6-inch diameter insulated line, all extending 500 feet from the tank farm to a point where fluids will be spilled for testing.

The facility has been designed to satisfy the requirement for information for risk assessment, emergency response, regulation, plant design, plant siting, and hazard mitigation. It is capable of spilling up to 53,000 gallons of cryogenic fluids, such as refrigerated ammonia, in two minutes. In addition, up to 24,000 gallons of ambient temperature materials such as chlorine can be released in five minutes. The sensor and data acquisition system is available to acquire data on spill characteristics such as rate, volume, temperature, and pressure; downwind gas concentration and aerosol characteristics; meteorological parameters; and blast or fire effects.

When spill tests are conducted, gaseous nitrogen (obtained by vaporizing the liquid) forces the test fluids from their storage tanks through the spill lines. Spill rate and duration, as well as test condition parameter checks, occur under computer control from the control building. Also, 700 channels of data originating from remotely located sensors can be recorded.

USERS AND POTENTIAL USERS:

The ultimate objective of the Liquefied Gaseous Fuels Spill Test Facility is to give both private and public sector users the technical data they need to better protect the public from the potential health and safety hazards posed by a spill of liquefied gaseous fuels or other toxic fluids. An aggressive effort, therefore, has been undertaken to apprise relevant sectors of the availability of this one-of-a-kind test facility. This effort has extended both to domestic and international organizations that have an interest in and need for safety-related data on liquefied gaseous fuels or toxic chemicals.

During calendar year 1986, tests funded by Amoco Oil Corporation were conducted to obtain downwind concentration measurements for hydrogen fluoride gas. The data has been utilized to assist in verifying atmospheric dispersion models. The test series consisted of six tests which examined downwind concentrations when hydrogen fluoride was released in a horizontal jet and the mitigation effects of various water-spray systems for controlling downwind dispersion. They value of these tests to industry is indicated by their interest in follow-on work in 1988, as discussed below.

In the 1987 test season, experiments were conducted for the Gas Research Institute and the Department of Transportation. These tests evaluated the effectiveness of "vapor fences" in mitigating the accidental release of liquefied natural gas at peak shaving plants. The test scenario was comprised of six large-scale releases of liquefied natural gas; the acquired data is being used in an attempt to validate wind tunnel simulations of vapor fence effects on heavy gas dispersion. Once validated, the wind tunnel models will be used to determine the vapor fence performance for several different accident scenarios.

Currently, test plans, agreements, and operational procedures are being negotiated between the Energy Department and a consortium of industry sponsors represented by Mobil Research and Development Corporation.

Mobil is a participant in the Joint Industry Hydrogen Fluoride Mitigation Program which is addressing the impact assessment of accidental releases of hyrdogen fluoride. On behalf of the participants (Amoco, Exxon, Marathon and Allied Signal, Inc.), Mobil is planning to conduct, during calendar year 1988, a series of releases which will test the effect of major variables on the mitigation efficiency of water-spray systems.

Also being negotiated for the 1988 test season are efforts to be sponsored by National Foam System, Inc., which will evaluate the efficacy of various foams in suppressing vapor releases from a variety of hazardous materials. These tests involving materials such as sulfur dioxide, bromine, phosgene and chlorine will be conducted in cooperation with their respective manufacturers.

During 1987 in response to the requirements of Section 118(n) of the Superfund Amendments and Reauthorization Act of 1986 and the legislative guidance contained in House Report 99-670, accompanying the Continuing Appropriations, Fiscal Year 1987, the Department entered into a Memorandum of Understanding with the Environmental Protection Agency and the Department of Transportation in support of a collaborative research and development program involving

hazardous substance spills to be conducted at the Spill Test Facility. The agreement allows the agencies, in collaboration with the private sector and other government organizations, to develop, structure and prioritize the establishment of a generic national research and development program germane to heavier-than-air gas dispersion, hazardous substance releases and related mitigating technologies. An action plan is in its final stages of formulation and is planned for implementation during calendar year 1988. As the program unfolds, it is planned that the Western Research Institute will be utilized to provide technical and analytical support to the collaborative effort.

FY 1989 BUDGET PROPOSAL:

The $0.766 million requested for fiscal year 1989 will provide for program continuity, stability and administration and allow for the fiscal flexibility required to supply the necessary responsiveness to prospective facility users in areas of cost estimates, environment, safety and health issues and approvals, pre-test documentation and scientific support.

Also, the requested funding will be used to provide for the management and maintenance of the Spill Test Facility, including the continuation of facility baseline operations support and continued technical interaction with potential sponsors of research. Appropriated funds for the Spill Test Facility have been supplemented by user fees.

There is a growing public awareness that the storage and transportation of pressurized, liquefied gaseous fuels and high vapor pressure chemicals are major commercial activities and that there are risks associated with these activities. Moreover, this heightened awareness appears to be part of an overall national trend that recognizes the dangers associated with hazardous substances. The need for further knowledge on releases of liquefied gases relates the activities of a number of Federal agencies, especially the Environmental Protection Agency, the Department of Transportation, Department of Defense agencies, and the Department of Energy. In addition, the concern of private industry is shown by those tests that have been conducted at the Spill Test Facility and those that are being planned.

The Liquefied Gaseous Fuels Spill Test Facility program has responded to these concerns by extending the capability breadth of the original facility design to include a broader range of substances that can be tested. Given its design capability for handling high vapor pressure and other potentially hazardous fluids, the facility is a national asset that is making an important "critical initiative" type of contribution for equipment standards, safety and control issues, and industrial regulations to help facilitate the growing attention that is rapidly focusing around the liquefied gaseous fuels and hazardous substances arena.

PHOTOVOLTAIC ENERGY RESEARCH

Senator JOHNSTON. Thank you very much, Mr. Gibbs.

Miss Fitzpatrick, your statement says that three photovoltaic options could be positioned for industry consideration of production scale up by the early 1990's. What kind of industrial application are you referring to?

Miss FITZPATRICK. This would be that the PV industry would be able to begin marketing products using advanced materials and cell designs by that time.

Senator JOHNSTON. The industrial application, is that for production of electricity?

Miss FITZPATRICK. Yes.

Senator JOHNSTON. For the plant, not central station production.

Miss FITZPATRICK. For both, for central station, grid-connected, or for local applications, and off-grid applications.

Senator JOHNSTON. What do you figure is the cost per installed kilowatt-hour?

Miss FITZPATRICK. Our goal is to get down under $2 a watt, so that would be under $2,000 a kilowatt.

Senator JOHNSTON. How far are you from that now?

Miss FITZPATRICK. We are now under $4 a watt.

Senator JOHNSTON. You are under $4 a watt?

Miss FITZPATRICK. That is right.

Senator JOHNSTON. What makes you think that you would get to under $2 by the early 1990's?

Miss FITZPATRICK. Because of improved efficiencies, so that the same area cell would give you a greater energy output, and also because of improved production techniques which will reduce the manufacturing cost for the cells. Those are the two main areas.

Senator JOHNSTON. But what is your degree of confidence that you can do that?

Miss FITZPATRICK. I am confident, talking to our researchers and also talking to people in the industry who are in the process of designing improved production facilities, they are confident that they can do it.

Senator JOHNSTON. What is the competitive cost of, say, a coal-fired plant by the early 1990's?

Miss FITZPATRICK. It is now, I believe, in the area of about $800 to $1,000 per kilowatt. So we are talking about something that is about twice what a coal-fired plant is for initial capacity. But, of course, the major cost of running a coal-fired plant is fueling it over the life of the plant, and photovoltaics, once you put the plant up, it has very, very low maintenance and operation costs, and no fuel.

Senator JOHNSTON. OK, but say a kilowatt of coal-fired electricity with a scrubber, what is that cost in the early 1990's?

Miss FITZPATRICK. I believe that it is around $1,000, or close to $1,000 a kilowatt.

Senator JOHNSTON. With a scrubber and everything.

Miss FITZPATRICK. I understand. I am prepared to be corrected by the fossil experts, but that is my understanding of approximately what it is.

SOLAR THERMAL ENERGY

Senator JOHNSTON. What is the cost of the electricity from that solar thermal out there, the LUZ plants, for example?

Miss FITZPATRICK. The solar energy generating stations?

Senator JOHNSTON. Yes.

Miss FITZPATRICK. Those generating stations are supplying electricity, mostly for peaking power, to the southern California grid. I will get it for the record, but the general market price for peaking power is around 12 cents a kilowatt-hour in that area.

Their contract price must be public information, since it is a public utility contract, and we will try to get that for you.

[The information follows:]

MARKET PRICE FOR PEAK-HOUR POWER

The market price of peak power depends on a wide variety of factors including the generation mix and capital costs of generating units of the local utility; the demands for power at various times of the day, the week, and the year; fuel prices; cost and availability of power and other utility interties in the power grid; and other regional and financial variables. Because of the variations in these factors, the market price can have a wide range. Utility practice is to use the new large units coming on line for baseload, and to use older less efficient plants or combustion turbines for peak capacity. Older plants typically have lower capital costs, but higher operating and fuel costs than a new base load plant. The cost of generation will also be heavily dependent on the load factor of the unit. A unit running 10 percent of the time would have four times as much capital cost recovery as a unit running 40 percent of the time. The total cost of generation of a typical combustion turbine peaking unit would be about 5 to 15 cents per kilowatt-hour, of which the cost of an oil or gas fuel at today's prices would be about 2 to 5 cents per kilowatt-hour.

Senator JOHNSTON. Does solar thermal promise the same cost reductions as photovoltaics does?

Miss FITZPATRICK. Solar thermal can now deliver electricity at a lower cost than photovoltaics can, rather substantially lower, but we have high hopes that photovoltaics will catch up to that in the foreseeable future, because photovoltaics now can deliver power for about 70 cents a kilowatt-hour.

PROBLEMS RELATED TO PHOTOVOLTAIC ENERGY SYSTEMS

Senator JOHNSTON. What do you see as your problems with photovoltaics? There is a problem with dust collection, you have to clean them.

Miss FITZPATRICK. Yes; it was thought that this was going to be a problem. It turns out to be not such a great problem. They tend to get washed by the rain or they can be fairly easily and cheaply cleaned. About once a month, just go out and spray them off.

You do degrade the efficiency of the array if you allow it to get dirty, that is true.

Senator JOHNSTON. When you talk about trying to get from $4 to $2 as a price, does that take into consideration storage, where you might have to store during the daytime, or do you figure that you won't have to store photovoltaics because it will be during the peak use, during the daytime?

Miss FITZPATRICK. I don't believe that figure includes storage. It does not. It all depends on how you want to use the system. If you want it as a peaking power system connected to your grid, then you are not particularly concerned about storage.

If you have an off-grid application, such as a navigation post or a communications relay station, and you want 24-hour operation or non-daylight operation, then you would have to have a storage battery, and that does, it is true, add to the cost of the system.

However, for off-grid, remote applications, photovoltaics is already on a life cycle cost basis, competitive with and can beat the alternatives, which are usually diesel-powered generators, and they have much lower maintenance costs.

The Coast Guard, for example, is currently converting 17,000 navigation aids to photovoltaic power, and they expect to save a great deal, especially on maintenance.

Senator JOHNSTON. They would have to have batteries, though, wouldn't they?

Miss FITZPATRICK. Yes; they do have batteries.

Senator JOHNSTON. What is the reliability of the batteries?

Miss FITZPATRICK. Very high.

RENEWABLE ENERGY POTENTIALS

Senator JOHNSTON. What do you see the future of all of this photovoltaic, as well as the LUZ-type projects, say, in the early next century?

Miss FITZPATRICK. We expect to see these sources grow, both in absolute generating capacity and in their share in contributing to the nation's energy needs. Renewables overall contribute 8 to 9 percent of our energy demand today. We expect that to go up to about 12 percent in the early part of the 21st century, and that is 12 percent of demand. Since demand will be growing, it will be much more energy than would be requested by 12 percent of today's demand.

Senator JOHNSTON. But a good part of that is wood chips and hydro.

Miss FITZPATRICK. Yes; a good part of it is wood, and a good part of it is hydropower, but a growing share is the other renewable sources.

Senator JOHNSTON. Sun energy, as I would call it, solar properly defined meaning something really coming rather directly from the Sun, is a minuscule amount right now, isn't it?

Miss FITZPATRICK. Right now, the nonhydropower, which is really solar energy, since it takes the Sun to evaporate the water——

Senator JOHNSTON. Gasoline is too.

Miss FITZPATRICK. That is true.

I remember, Dr. Trivelpiece claiming last year that it was all really fusion power, which I suppose is correct. [Laughter.]

At any rate, the nonhydropower generating capacity now, renewable generating capacity in the United States, is about 1 percent of our total electric generating capacity. It is about 6,800 megawatts.

Senator JOHNSTON. Most of that is wood chips?

Miss FITZPATRICK. A large share of it is wood chips. Less than half of it, about 3,000 megawatts, is wood chips, about 1,500 megawatts is geothermal, and about 1,200 is wind, and the rest is scattered through solar thermal, and the others.

There are 2,500 megawatts currently under construction, and these systems have fairly short lead times, so that I would expect that to come on line in about a year. The projections are that these systems are going to continue to grow. I think, in large part, the rate that they grow will be dependent upon the conventional fuels cost and how attractive these systems can be made to be, both technically, from a reliability standpoint, and from an economic standpoint.

Senator JOHNSTON. Frankly, we overhyped solar energy in this country a few years ago. Jimmy Carter said we are going to have 20 percent solar by the year 2000, and suggested, by definitional sleight of hand, that it was going to be photovoltaics and that sort of thing, cheap energy from the Sun. Everyone tried to celebrate that and finally realized that that wasn't so.

Now, I think we may be overcompensating in the other direction now, and that is why I am anxious to find out the latest breakthroughs. If photovoltaic is competitive, then it absolutely wipes out other sources, at least in the sunny climates.

Is that a real possibility? Do you see an all across the Southwest, in the 21st century, using photovoltaics or some sort of Sun energy virtually exclusively?

Miss FITZPATRICK. I wouldn't say, "virtually exclusively," Mr. Chairman. I think your point is very well taken that there was a lot of hype and a lot of things that were said in great hope before anyone had had a chance to take a very careful look at the technical challenges and the economic realities.

In a certain sense, the industry suffers today from a credibility gap because so many promises were made, and people bought systems that turned out not to work very well because nobody had done his homework on it very carefully. That is a hump that industry now has to get over by producing a quality product and serving the customer.

The prospects of going exclusively solar, I think, will be driven in large part by economics. There is no need for us to be exclusively solar, we have other options. If solar turns out, in certain instances, in certain areas, for certain applications, to be the technically and economically preferable choice, then we ought to be sure that we have done the research to make it available.

Senator JOHNSTON. What is the value of photovoltaic cell sales in dollars each year?

Miss FITZPATRICK. Worldwide, I think I have those figures. The worldwide total in 1987 was 28.6 megawatts.

Senator JOHNSTON. In terms of dollars, what would that be?

Miss FITZPATRICK. I think that it is about $200 million a year, just in cells themselves. That is not for anything else in the system, it is just for cells.

Senator JOHNSTON. Is this a sufficient amount of spending to develop photovoltaics? I see you have a $24.2 million budget here; is that enough?

Miss FITZPATRICK. I think that it is enough. It is tight, but I think it is sufficient to achieve our program goals. Industry spending is also going up in the United States, that is running about $50 million a year.

Our work is done in large part in collaboration with industry. We have several projects with the leading photovoltaic manufacturers in the United States, which are running on 50-percent cost shares. Those have been quite successful.

Senator JOHNSTON. On the one hand, I hear that there is the possibility of these huge breakthroughs, figures that we thought were unattainable a few years ago, and that really look very promising. Yet I see a relatively small budget compared to the money we used to spend. We used to spend in the hundreds of million of dollars for photovoltaics.

Miss FITZPATRICK. Yes, sir.

Senator JOHNSTON. I suspect we spent, counting tax credits, billions, I guess, on solar energy in this country, not most of that on photovoltaics, but at least it makes me wonder whether or not that is enough.

Miss FITZPATRICK. I think you are right. We did a count about 2 years ago, and I think we came up with something like $5 billion in outlays plus credits for renewable energy.

WIND ENERGY RESEARCH

Senator JOHNSTON. What are you doing in wind energy research?

Miss FITZPATRICK. In wind energy, we are concentrating on structural mechanics of the wind turbines themselves. This has turned out to be one of the serious problems with wind turbines. After a year, or 2 years, or 3 years, maybe a little more, in operation, the turbine blade undergoes structural fatigue and can, in fact, break. This has been a problem with virtually all wind turbines.

Senator JOHNSTON. I fly between San Francisco and Yosemite, over those wind farms—how much has been invested out there, how many tens of millions?

Miss FITZPATRICK. I couldn't tell you, but it has a lot of wind turbines, though, thousands of them.

Senator JOHNSTON. But most of them are not turning, why is that?

Miss FITZPATRICK. If you go over on a summer afternoon, they are turning.

Senator JOHNSTON. Say that again?

Miss FITZPATRICK. If you fly over on a summer afternoon, they are turning. The newer turbines on the well-managed wind farms have an availability of over 95 percent.

Senator JOHNSTON. I am usually on summer morning. They turn only in the afternoon?

Miss FITZPATRICK. They are designed to turn as summer peaking power. That is their main function, to supply the utilities with summer peaking power. They are placed on that site because, typically, the winds do rise in midday in the summertime and flow from the coast over that mountain pass into the desert to the east.

Senator JOHNSTON. They are still working?

Miss FITZPATRICK. Yes; they work.

Senator JOHNSTON. They just don't pay off?

Miss FITZPATRICK. No; they are paying off. Those are going concerns now, and that technology is attracting a good deal of private investment.

OCEAN ENERGY SYSTEM RESEARCH

Senator JOHNSTON. Ocean energy, is that the old OTEC?

Miss FITZPATRICK. Yes, sir.

Senator JOHNSTON. But they didn't build the OTEC. They built mini-OTEC, was it?

Miss FITZPATRICK. We built a very small shipboard, barge OTEC plant.

Senator JOHNSTON. Is it still operating?

Miss FITZPATRICK. No; it was dismantled several years ago. We have, at the Seacoast Test Facility in Hawaii, a new cold water pipe, and we are doing heat exchanger and turbine compressor experiments. Our eventual goal is to operate a 165-kilowatt OTEC system.

Senator JOHNSTON. The last time I did a fix on that, that looked like an absolute candidate for noneconomically passing muster. Isn't that so?

Miss FITZPATRICK. Mr. Chairman, if you look at our budget request, you will see that we don't ask very much for it. I have to admit, that from the United States point of view, for solving our energy needs, OTEC is not at the top of our priority list.

Senator JOHNSTON. Why $3.1 million?

Miss FITZPATRICK. Because there are a number of things that can be done that we would need for an OTEC system, such as heat exchangers, low-pressure compressors, and high-volume pumps, that would be useful in other applications, especially the heat exchangers.

There is also a good possibility that the technologies developed, that would be useful in an OTEC system, would also be very useful for a bottoming cycle, that is, taking warm waste streams from conventional powerplants, for example, and extracting the energy that we are now throwing away into rivers, for example, in many cases.

If we had the ability to make use of fairly low temperature waste streams, we could, in fact, have a large energy gain. This would be useful in other applications than ocean thermal.

Ocean thermal does have the possibility of being attractive for tropical, and especially island applications, if you could economically build a plant, say, in the 5-megawatt range.

Senator JOHNSTON. But to build a plant in the 5-megawatt range, it would be enormously expensive. You would have to develop this enormously expensive technology, which you could use only two or three places in the world—Puerto Rico, Hawaii, the Philippine Trench—or something which would produce but 5 megawatts and that is about all you would need. I have never understood it, but it is not much money, as you point out.

SOLAR ENERGY RESEARCH INSTITUTE FACILITY

Why do we need to build a new building for SERI? When solar energy has been going down and down, why do we need to build a 100,000-square-foot building in a time of budget stringency?

Miss FITZPATRICK. The reason is that most of the laboratory facilities at SERI are in what is really a converted office building. The building was not put up as a laboratory, and it has had to be refitted with the equipment and systems that are necessary for a laboratory.

We are at this point stretching the bounds of what can be effectively and safely done. For example, there are no special facilities to handle toxic materials, either to store them or to use them. We need to have safer ventilation systems and evacuation hoods. We can't now isolate the laboratory's air supply and exhaust.

We have even had instances where we have had to remove the external wall of a building in order to bring equipment in. The building was not designed with the elevator and hallway passages for moving laboratory equipment.

We have reached the point where the facilities that are there are not adequate. They are not safe for doing the work that we know is going to have to be done in our future solar research. We think that a new building is justified, even at the relatively reduced levels of funding that we are proposing.

Senator JOHNSTON. I would have to be persuaded that we have the money to be able to do that.

SUPERCONDUCTING SUPER COLLIDER

Dr. Decker, you have a ramp up from $25 million to $363 million for 1989 for the SSC. Can you do ramp up that fast in 1 year?

Dr. DECKER. I believe that we do have a reasonable plan for doing that, and I think that it is what it really takes to keep the project on the schedule that we have laid out. There is a ramp up in the research and development from $25 to $64 million that will be used to continue research and development on the magnets and also to start doing some research and development on the detectors. The capital equipment request of $16 million also really supports the research and development program and will provide for vesting and analysis of magnets and other components and systems.

In the construction area, mostly we are talking about doing detailed engineering design for technical systems and conventional systems. To date, what we have are conceptual designs, and we need now to move to detailed design.

We also have a number of long-lead procurement items that we need to acquire, things like injector technical components, which are early critical path items. We also have some other long-lead procurement items such as magnet tooling, superconducting materials, magnet steel, and so forth.

Senator JOHNSTON. I just can't imagine being able to ramp up that much. You don't have an EIS, and that is going to delay this project a great deal. We don't know how it is going to be managed and who is going to manage it. We have thought about the need to put out an RFP for a management contract. I don't know whether you need that.

I know you are having problems with your magnets. They don't quench. Does it mean that the magnetic field is not right, not up to power, or something?

Dr. DECKER. Let me say a few words about the magnet development program.

We have, of course, built the Tevatron at Fermilab using superconducting magnets, and we have a fair experience base from that machine. We set out to improve the magnet design over what we did use at Fermilab to try to keep the costs of the SSC down.

We set out to do things like improve the current carrying capability of the wire by 50 percent, to increase the field strength of the magnet by 50 percent, to reduce the heat loss by a factor of six. We have been able to achieve most of those goals. We have, in fact, achieved all of them in the short magnets that we have built, the 1-meter magnets and the 4-meter magnets.

With the full length magnets, which are 16.5 meters, we have met almost all of those design criteria. We have had some problems with what is called training. That has been the most significant difficulty that we have had. It is not a major problem, it is a mechanical problem, or at least that is what causes it. We have several possible solutions for fixing that, and I think that we will, in fact, have that problem fixed very soon.

Senator JOHNSTON. What is the quenching problem?

Dr. DECKER. The quenching problem, I think, is one and the same as this training problem. When you start ramping the current up on a new magnet, it will get up to a certain value, and then it will quench. Then you ramp it up again, and it usually goes up to a higher value, and it may quench again until you get up to the full-field capability of the magnet.

Senator JOHNSTON. None have worked to specification, though, have they?

Dr. DECKER. They have worked to the field specification. Yes, they have reached field specifications, it is just that training is not as good as we would like. Certainly, before we go into production, we would like to fix this training problem. As I say, I think we have a number of approaches that will work and we can fix it reasonably soon.

Senator JOHNSTON. Someone may come along and give this subcommittee $363 million, but I haven't seen him yet, and it is a long time until Christmas. As I see it at this point, the hope for SSC is that you can get a smaller budget, put off the major construction commitment for a while, and hope, in the process, that somebody can find a way to finance construction. They haven't thought of anything yet.

The administration submits a budget proposing to cut out the Appalachian Regional Commission, which is OK with me and Senator McClure, because we are not part of Appalachia. Even Senator Domenici doesn't have that problem.

Senator DOMENICI. They have done it three times and it hasn't stuck.

Senator JOHNSTON. So, those kinds of cuts are just not realistic. Congress continues to fund those programs year after year. So I don't know where we are going to get the money for SSC.

Really, $363 million, I must tell you, seems vastly premature. I just don't see how you could spend that kind of money. Maybe you can obligate it, but I rather doubt it, if you got it. There is this figure of continued R&D of $64 million. $65 million is for long-lead procurements for components. Most of this is for developing overall industrial capability.

I am just trying to figure out a firm way to fund SSC.

Can you give us an alternative amount for R&D that would be helpful, but would not involve a commitment of a large expenditure for construction and long-lead items?

Dr. DECKER. I don't believe I could today. The R&D funding is particularly important to this project at this stage.

Senator JOHNSTON. I wish you would come back with a figure. I don't ask you to be against your own project, and against your own budget, but I ask you to assume that what I say is probably correct, that $363 million is out of the question. What would be useful for R&D and what would it do to your schedule?

We don't want to just throw money at the problem and waste it, but what would be useful, and I am thinking of something in the neighborhood of $60 million, in that area, maybe we could find that just in the budget.

Then, of course, there will be the question of whether we should do it at all, which the committee has not made that determination, but I would like to get the widest range of options that we can.

Senator DOMENICI. Mr. Chairman, would you yield on that?

Senator JOHNSTON. Certainly.

SSC INTERNATIONAL PARTICIPATION

Senator DOMENICI. Might I just share this with you and Senator McClure and Dr. Decker.

At some point, as you know, the SSC is supposed to be an international project, both from the standpoint of its utility and from the standpoint of paying for it. The difficulty we are having surfaced again in the authorizing hearing when we tried to inquire at what point in time we would get a better picture of the actual cost to the federal government. We are having difficulty with that as evidenced when I asked whether we could condition an appropriation upon producing the international game plan. The answer was that that would not work.

Then there is the issue of state participation. As you know, to this point, states have not been able to indicate what they will contribute to the project because of the amendment that I offered and you all supported.

Incidentally, I did hear from the National Academy of Sciences that the amendment was actually helpful, rather than harmful, in their evaluation of the sites. They claim that had they had to evaluate those aspects, they probably would have been even more arbitrary in their decisions than they currently appear to be, and that they might not have been able to get it done.

But, I think a relevant question is at what point in time, when we start appropriating, will we get a full game plan of the federal cost?

Your question of how much we should put in for the very, very first phase of the SSC to keep it alive seems to me to lead to a question of when we will get a full proposal. It is not going to cost us $5 billion if what DOE has been telling us is true, that the Japanese seem to want to pay, and others in Europe do, too. The site of the SSC project is also an important factor. If you pick Texas, they might pay for the whole damn thing out of oil receipts. They said they could put up $1 billion at one point.

Senator JOHNSTON. That is the old Texas.

Senator DOMENICI. That was the Texas of a long time ago. [Laughter.]

Thank you for yielding. Perhaps you could comment?

Dr. DECKER. I wish I could give you an answer as to a date when, in fact, we would have foreign support lined up and so forth.

As I think you know, we have just opened formal discussions with six countries on this topic. It will take each of them varying times to reach some sort of decision. In talking with the Japanese most recently, it could well be a year's time for them to make those kinds of decisions. It is very much a grassroots kind of a bottom-up process in Japan.

It has also been clear to us in our discussions with many of the countries that they are, of course, watching to see what Congress does on the budget for the project. I am not sure that we will get solid commitments before we have a good and solid indication that the Congress, in fact, wants to proceed with the project.

We are a little bit in a chicken and egg situation on this, unfortunately.

Senator MCCLURE. Would the chairman yield on that point?

Senator JOHNSTON. Yes.

Senator MCCLURE. It really leaves us, then, in the position, does it not, as a country, as a Congress, as an administration, to a commitment to doing it all ourselves, with no participation?

Dr. DECKER. I think, from my perspective, it would be good if we could make a commitment to move forward with the project. I am very certain, if we could make that commitment, that, in fact, we would get very significant participation by a number of other countries, certainly beyond the six that we have already talked to. We have had informal indications that there are a number of other countries, smaller countries, maybe contributing smaller amounts, but nonetheless adding up to significant contributions.

Senator McCLURE. I understand that, yet I am not at all certain in my own mind, at least for myself, I am very comfortable with the notion that either we will get that participation and, therefore, we can depend upon it, and we are not really committing all of the funds in the United States for it 100 percent.

In the past, I have seen some foreign participation in which they got a lot more than they invested. They have a tendency to want to invest just enough to have full access to all of the benefits, without actually making a proportionate investment in the cost.

I am not at all certain that I want to go down that road again, and I would want the administration and our foreign friends to understand that at least one Member of the Senate is going to want to demand that they make a proportionate investment or they are not going to participate.

There are two different kinds of questions that we have to ask ourselves with respect to foreign participation.

Senator JOHNSTON. There is another more basic question as I see it. Why not let them build it and let the United States participate, which is really quite a serious question, because the benefits are benefits for all mankind, they are a little bit hard to quantify for the United States alone, especially at this price tag.

Let's talk about the magnetic fusion. Do you have a total price for the new Tokamak?

MAGNETIC FUSION PROGRAM

Dr. DECKER. Yes; our current estimate is $426 million for the total estimated cost of the project.

Senator JOHNSTON. $426 million?

Dr. DECKER. Yes.

Senator JOHNSTON. That is over——

Dr. DECKER. For 1996 completion.

Senator JOHNSTON. $705 million I see here for operation.

Dr. DECKER. The total project cost, including all of the diagnostics, R&D necessary to complete construction, and other related operating costs, as well as the construction costs, is $556.5 million. The $705 million includes preparation for operation in 1995 and the 1996 operating costs. Operation is estimated to begin in January 1996.

Senator JOHNSTON. How many other generations would there be between this machine and one that would really produce electricity?

Dr. DECKER. The Compact Ignition Tokamak that is proposed would get at the one very important remaining physics question in fusion, and that is the physics of an ignited plasma. Beyond that, to establish a firm engineering basis for fusion, there needs to be a device that, in fact, is aimed at engineering and fusion technologies. We see one device beyond this Compact Ignition Tokamak that would be required to do that.

I think once the engineering test reactor, as it is being called, is built and operated, then you would have built the science and the engineering information to decide whether or not to proceed with commercial fusion reactors.

Senator JOHNSTON. Doctor, I used to ask the question, some years ago, on this. It seems to me that we were talking about commercialization, if you had it, would be 2030, or around that time, or 2040.

Is that still valid?

Dr. DECKER. Yes.

Senator JOHNSTON. Is that too far away?

Dr. DECKER. I would think, given where we are today, that we could not complete this engineeering test reactor before the year 2005, or so. It would probably be realistically 20 years beyond that to commercialize fusion as an energy source.

Senator JOHNSTON. You would need a commercial test reactor before you went to replications in the market.

Dr. DECKER. Yes.

Senator JOHNSTON. I also used to ask what would be the use of fusion, whether it would be as an electricity generation or maybe as a breeder. Do you know enough yet to be able to say what you think the use would be?

Dr. DECKER. Both of those are certainly possible. I think you will get varying opinions on that in talking with different people in the field. My guess would be that it would be electricity production.

GREENHOUSE EFFECT

Senator JOHNSTON. One final question on the greenhouse effect; I guess that would be for Mr. Gibbs.

Tell me about research and your theories on the greenhouse effect at this point?

Dr. DECKER. Well, certainly there is no doubt that the CO_2 concentration in the atmosphere has gone up by about 25 percent over the last 185 years. Most of the people who do global climate modeling would tell you that that will lead to some sort of a temperature increase. I think there is a lot of uncertainty as to when and how much.

Senator JOHNSTON. Has it already led to that increase?

Dr. DECKER. I don't believe that there is any evidence of that that is really supportable. You will find some varying opinions on that.

Senator JOHNSTON. There are those who say that it has already increased the global temperature, that some of the weather eccentricities that we see are caused by that.

Dr. DECKER. There are a lot of weather eccentrities, as you call them; whether any of them can be pinned down to CO_2 or any other specific cause, at this point, I think it is very tough.

Senator JOHNSTON. What more can we do? Invent more powerful computers?

Dr. DECKER. Certainly, the computer modeling is an important part of it. There are right now significant variations among the different climate models. There are really a lot of differences when it comes to predicting changes in regional climate, whether there will be an increase or a decrease in precipitation, for example, which is, of course, critically important, especially if you are in a farm region.

SUPER COMPUTER TECHNOLOGY

Senator JOHNSTON. Do you know anything, by the way about the new computer at Sandia?

Dr. DECKER. Yes, sir.

Senator JOHNSTON. Can you tell us about that?

Dr. DECKER. I know a little bit about it. One of the most promising ways to improve the performance of computers is to use a number of processors working on the same problem.

This has been the subject of research for some time. The question is, let's say that you have a 10-processor system, can you solve a given problem 10 times as fast as if you only had 1 processor working on the problem.

Senator JOHNSTON. From reading about the program, I couldn't tell whether it was sort of a breakthrough in programming so that they could, by the program, break the problem down into component parts, or whether it was a breakthrough in hardware.

Dr. DECKER. I am not sure of the details either, Senator. I suspect that it is a breakthrough in decomposing the problem so that it can be solved on 1,000 processors. That is the real key here, that research has been done using processors that may be up to 10, 20, 30 processors, and people have been able to achieve these significant speed ups by a factor of 20 or 30.

The question is, if you went to 1,000 or higher numbers, could you continue to get these speedups?

Senator JOHNSTON. It is probably mainly a computer program that did that.

Dr. DECKER. I am sure that that is the case.

Senator JOHNSTON. Senator McClure.

Senator MCCLURE. Let Senator Domenici.

Senator JOHNSTON. Senator Domenici.

CONFINEMENT PHYSICS RESEARCH FACILITY

Senator DOMENICI. Thank you very much, Mr. Chairman. I will submit a couple of questions in writing to you, but I just wanted to clear up a couple of things.

For the Magnetic Fusion Program, in particular the confinement physics research facility at Los Alamos, the budget submission indicates that $52.5 million is the total estimated cost for the construction of that project, which is very urgently needed.

As I understand it, and you can tell me if I am correct or not, that project cannot be built for $52.5 million. That estimate is included because OMB has continually assumed that there would be $20 million or so provided by the private sector, which has not occurred. Consequently, the actual cost of the project is $72 million; is that correct?

Dr. DECKER. Yes, sir; that is basically what has happened. It is an important project for the fusion program. We have it under review at the present time. We will come forward with a new data sheet, one which has a scope of the project and a cost that are compatible.

Senator DOMENICI. When will you have that done?

Dr. DECKER. Soon; I think that it is a matter of a few weeks.

Senator DOMENICI. You will submit it to the committee?

Dr. DECKER. Yes, sir.

HUMAN GENOME INITIATIVE

Senator DOMENICI. Thank you.

With reference to the genome initiative as I understand it, the Department of Energy is a partner with the National Institutes of Health and is moving ahead rather substantially with the genome mapping and sequencing initiative.

Is there any controversy with reference to the request in the President's budget for additional monies for DOE to accelerate the mapping technology work which is being done at Los Alamos?

Dr. DECKER. I haven't run into any controversy yet.

Senator DOMENICI. There are two aspects to the budget request—increased funding for DOE and increased funding for NIH?

Dr. DECKER. That is correct.

Senator DOMENICI. Both are needed, as you understand it, to move ahead with a goal oriented project?

Dr. DECKER. Yes; they are. We are working very closely with NIH. In fact, I just recently suggested to Jim Wyngaarden, the Director of NIH, that we set up a joint advisory committee for this program. He has agreed and we are in the process of doing that.

Senator DOMENICI. Do I read in that that there is now a commitment to proceed with some kind of advisory group between the two agencies and others interested in genome mapping initiative?

Dr. DECKER. Yes, sir.

Senator DOMENICI. Have you had an opportunity to review the Chiles bill, S. 1966, that would set up the advisory commission on genome mapping and sequencing headed by DOE and NIH on a rotating basis?

Dr. DECKER. I can't say that I have reviewed it in detail. I am aware of that provision.

Senator DOMENICI. So what you are telling us is, even without a statute creating it, it is the intention of the Department to create something similar to that commission to manage the genome effort being undertaken by various federal agencies?

Dr. DECKER. Yes, sir; that is correct.

Senator DOMENICI. Has there been a commitment with reference to genome mapping beyond what you have described here?

There are some national reports saying that we should proceed with the full mapping of the human genome and set some national targets. Has that been done within the Department, or are we still proceeding with a rather piecemeal approach to this project?

Dr. DECKER. What the Department believes is important is to develop some new technologies that will, in fact, greatly reduce the costs of this undertaking. So we are concentrating on developing those new technologies.

We are concentrating on increasing the capability to physically map the genome, to automate sequencing techniques, and on developing the data-handling capability for this project. This project will produce large amounts of data, and we need to have it in a form that people can, in fact, make very good use of it.

PREPARED STATEMENT AND QUESTIONS SUBMITTED BY SENATOR DECONCINI

Senator JOHNSTON. Senator, would you yield at this point?

Senator DeConcini had wanted to be here, but he is chairing a Patents and Copyright Subcommittee hearing. I think that may be the one on Jimmy Stewart's legislation, the movie star who was here this morning. He has a statement and some questions which he would like to place in the record.

[The statement follows:]

STATEMENT OF SENATOR DENNIS DECONCINI

The Administration's budget request for the Superconducting Super Collider (SSC) for FY 89 is superb. I commend the Department for its initiative in the funding of basic science overall, and feel confident the $363 million request for the SSC next fiscal year will keep this very important scientific project on track. If we intend to be a competitive nation offering our students stimulation and a challenge in the investigation of unchartered scientific waters, we have no choice, we must charge ahead with our plans to build the Supercollider. It is truly an investment in this nation's future.

I am cognizant of the budget limitations confronting the Congress and especially this Committee. Finding the $363 million necessary to keep the SSC on track as planned, will be difficult at best. But, I believe we must use that same American ingenuity we have used to compete in the scientific arena, to develop a plan to finance the project without draining our Federal budget. It certainly has become a matter of priorities -- science needs to take its rightful place alongside our other national funding priorities. It will not be an easy year to come up with the additional dollars for the SSC. However, I will work with all members of this Committee and the Administration in an attempt to develop a way to make the Supercollider a reality.

QUESTIONS BY SENATOR DENNIS DeCONCINI

Superconducting Super Collider

Question: Of the $363 million requested for development of the SSC, $64 million has been allocated to continued research. If the Congress does not provide funding for construction and procurement in FY 89, will additional research funds be necessary to continue the efforts to move us toward development? If so, what would be an adequate research budget for FY 89?

Answer: I would like to first point out that both the $64 million of operating funds and the $16 million of capital funds requested are for the R&D program. The R&D planned for FY 1989 is highly important for the project whether or not construction funds are provided in FY 1989. Thus far, the R&D effort has concentrated on the superconducting dipole magnets. These magnets represent a substantial fraction of the cost of the project and a careful R&D plan has been laid out, leading to cost-effective and reliable magnets produced in industry. The plan involves many steps and these magnets are on the critical path. An important facet of the FY 1989 program is the start of substantial R&D efforts by industrial firms. R&D on other aspects of the SSC has been proceeding at a slower than desirable pace due to funding limitations. It is highly important in FY 89 to address these other areas in a more vigorous fashion so that we can proceed to the final engineering design. Of the construction request, $47 million is for detailed design of technical systems and conventional facilities. This design work is also on the critical path and should be pursued vigorously in FY 1989. Most of these design activities could be carried out under the R&D program with appropriate language from the Congress.

Question: What will happen to the U.S. chances of building this project before a foreign competitor if the construction dollars for the SSC are not appropriated in FY 89?

Answer: The large Western European laboratory near Geneva, CERN, is planning to make a decision in mid 1989 on whether to recommend to its sponsoring countries construction of the Large Hadron Collider, LHC. If approved, this facility would be built in the recently completed 17-mile circumference LEP tunnel. The LHC would be a proton-proton collider, like the SSC, but with an energy about one-third that of the SSC. While many scientists believe it could not adequately explore the mass region predicted to be of interest, it could well make discoveries which would otherwise be reserved to the SSC. If the SSC were not built, the LHC would be the premier, highest energy facility in the world for many years. The 1989 decision at CERN will be made "taking into account the evolution of the world situation." If the SSC, at that time, is on track, it seems likely that the Europeans would concentrate on developing other types of new facilities, rather than trying to compete against the SSC with a similar, but inferior facility.

Question: I have repeatedly discussed with the Department the need to develop some type of creative financing for the SSC. I know the Department has sent "teams" to several countries to discuss foreign contributions. Of the countries visited, can you give me an indication of which countries would be likely to lend financial support to the project?

Answer: I would like to preface my remarks by noting that we have only had preliminary discussions with foreign countries and no firm commitments were either sought or received. The reception was positive in all countries we visited and I believe we will very likely get some level of participation from all those countries. While many of the contributions are likely to be for detector fabrication, there is a strong possibility of significant construction contributions to the project from several countries. I believe it is premature and possibly counterproductive to identify specific contributions from specific countries at this early stage of discussion. In any case, we expect the contributions to be primarily "in-kind," i.e., accelerator and detector components, rather than cash.

Question: From these discussions, can the Department make any type of guess as to how much money can be expected from foreign sources?

Answer: I believe that we have a good chance of getting at least 20 percent from foreign sources and perhaps as high as 40 percent in the most favorable circumstances.

Question: Wouldn't it be easier for the Department to "sell" this project to Appropriations Committee if it developed a funding package which included specific estimates to be contributed form various sources, i.e., 50 percent from foreign sources, the remainder from private sources in this country and general revenues, or something of this nature?

Answer: I realize that the Congressional Committees would feel more comfortable if we could present a plan identifying specific foreign contributions. However, we are in the early stages of discussions and all of the foreign countries have made it clear that they are not prepared to enter into definitive negotiations and make commitments until there is a U.S. commitment to the project. For purposes of out-year funding projections, an estimate of $1.8 billion was made for non-Federal contributions to the SSC project costs. As shown in the SSC Construction Project Data Sheet, submitted as part of the President's FY 1989 budget request, these contributions were assumed to start in FY 1991.

Question: Has the Department considered any alternative financing proposals for the SSC short of funding the entire project from general revenues? If so, can you give me some examples of what has been under discussion? If not, please explain why not.

Answer: No, we have not considered in detail alternative financial proposals other than our efforts to secure international participation. It had been our plan to seek state and local contributions, including creative financing schemes, as part of the site selection process but the Domenici amendment has prohibited us from doing that. Some alternate financing has been suggested by industry, but the cost effectiveness of such arrangements has yet to be studied. For example, industry might sell us liquid helium and liquid nitrogen as needed, rather than our constructing the large refrigeration facilities as part of the project.

Question: In FY 88, $25 million was appropriated to continue preparation activities relative to selection of a site for the SSC. I understand that earlier estimates of need for environmental analysis, testing and review were lower than now envisioned. Does the Department have a shortfall of funds to complete the environmental work necessary to select a site for the SSC later this year? If so, what is the shortfall and how do you expect to complete your activities?

Answer: Yes, there is a shortfall. The Administration's FY 1988 budget request proposed $25 million for operating expenses and $10 million for construction for the SSC. Congress appropriated $25 million of operating expenses for two purposes: research and development and site selection costs. DOE had underestimated site selection costs. Upon availability of more definite information and a careful analysis it has been determined there is a need for a total of $33 million in FY 1988, including $8 million for site selection cost and $25 million for research and development. If held to a total of $25 million, research and development would receive $20 million and site selection would get only $5 million. Therefore, there would be a shortfall for site selection activities in FY 1988 of $3 million and in order to stay on the research and development schedule an additional $5 million is required for research and development. In February, we requested an additional $8 million for necessary research and development and site selection activities during FY 1988.

Virtually all of the $3 million for site selection would be directed to the preparation of the Environmental Impact Statement. The additional $5 million required for research and development is necessary to continue the momentum principally on development of superconducting magnets which are a critical technical aspect of the program and a major element of the total cost.

If the reprogramming request is not approved, we would still identify a preferred site in November, but would need to defer completion of the Environmental Impact Statement and the identification of the final site until late 1989. Research and development would be severely curtailed to $20 million instead of the $25 million required to continue.

Solar Buildings

Question: As you know, I have been very interested in completion of the open cycle solar cooling project at Arizona State University. I understand the FY 88 need for this project is about $214,000. Has this amount been funded by DOE this year? If not, why not?

Answer: The Solar Buildings Program has been funding research in open cycle solar cooling at the Arizona State University since 1981. As a result of the project's research findings, the direction of the work has been modified to concentrate on essential fundamental issues, such as evaluating corrosion effects and the resulting environmental impacts of entrained contaminants. The focus has been on modeling and experimenting with materials and components, such as film absorbers, low cost sorbents, and glazed or unglazed collector/regenerators. A total of $110,000 has been allocated to this project in FY 1988.

Question: I see the Administration is again requesting a reduction in funding for solar buildings. How much funding will be necessary to maintain a continued research effort on the level of that in FY 88 for open cycle solar cooling? Will that amount allow the DOE to continue the ASU contract at the FY 88 rate?

Answer: The Solar Buildings Program intends to continue funding the open cycle solar cooling research at Arizona State University in FY 1989 at the same level as FY 1988. Private industry cost-sharing will be solicited for this research endeavor which, if successful, could reduce the DOE requirement.

BORON NEUTRON CAPTURE THERAPY

Senator JOHNSTON. I am going to have to go to another meeting, so if you would take over.

Senator DOMENICI. I have finished, and I thank you, Mr. Chairman.

Senator JOHNSTON. Senator McClure.

Senator MCCLURE. Thank you, Mr. Chairman.

I only have a couple of questions. I may submit some for response in writing. I want to talk for just a brief moment on the boron/neutron capture therapy.

Last year, the Department of Energy committed to support the BNCT project with necessary funding, $9.9 million in fiscal year 1988. The committee strongly supported that statement of support for BNCT and it also reprogrammed $5 million from a decommissioning account in the Nuclear Energy Office to the project. The Office of Energy Research was to provide the remaining $4.9 million for this fiscal year. The National Cancer Institute has made a visit to the site, talked to various people who are involved in the project, and are to submit a report.

Have you any preliminary information on the substance of the NCI report?

Dr. DECKER. Not really, Senator. My understanding is that their report will come out about April 1.

Senator MCCLURE. I am a little bit concerned. Obviously, we want the best information we can get, but I am a little bit concerned because we are always slipping behind the schedule, which maybe the schedule was too optimistic to start out. But we are talking about human experiments starting 3 years from the time they were talking about, and we are probably at last 6 months behind that schedule now, if I understand that correctly. Am I about right?

Dr. DECKER. That could well be, Senator. I am not sure exactly where we are on that schedule. Review committees always seem to take a little bit longer than any of us would like.

Senator MCCLURE. I understand that. I am very interested, as you know, and I do intend to follow that very vigorously. I want to be as helpful as I can be in that process.

Dr. DECKER. Thank you.

ADDITIONAL PREPARED QUESTIONS SUBMITTED FOR THE RECORD

Senator MCCLURE. I have some further questions, as do Senator Johnston and Senator Inouye, which I will make part of the record.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR JOHNSTON

Compact Ignition Tokamak

Question: With regard to the Compact Ignition Tokamak, has this proposed concept been reviewed by the U.S. and international fusion communities? Are they supportive of the project as it is currently envisioned?

Answer: In January 1988, the CIT was reviewed by an international panel of senior scientists from the U.S.A., Europe, Japan, and U.S.S.R. The panelists strongly endorsed proceeding with the CIT on an expeditious schedule. They noted that CIT will be the only DT fusion experiment in the world between the completion of TFTR and JET in the early 1990's, and the start-up of an engineering test reactor, after the year 2000. Most of the specific technical recommendations from the international panel members are now being incorporated in the CIT design.

From its inception, the CIT project has been guided by an Ignition Technical Oversight Committee (ITOC) that is made up of leading scientists and engineers from the U.S. fusion program. The national CIT team has followed the ITOC guidelines throughout the design evolution. In addition, an ignition physics study group composed of over 100 scientists from across the U.S. and foreign fusion programs developed the physics basis of the design. Finally, both the Magnetic Fusion Advisory Committee and the Energy Research Advisory Board have urged timely completion of this project as the most important next scientific step in fusion development.

Question: Research projects have historically cost more and have longer schedules than predicted. TFTR is certainly an example in the fusion program. Do you have confidence you can meet the CIT cost and schedule? If so, on what is this confidence based?

Answer: The program is confident that the cost and schedule baselines for the CIT construction project can be met. The CIT conceptual design exceeds all other projects in the fusion program's history in terms of the level of detailed analysis and refinements for this stage of the project. In addition, the CIT national team is making full use of cost data based on the past fusion projects of similar size such as Doublet III-D and TFTR. The FY 1996 completion date is realistic, assuming the requested funding profile is provided.

Question: Your testimony indicates you plan to achieve DT breakeven in TFTR in 1991. As you know, this country has a serious deficit problem. Since CIT promises much more than TFTR (ignition rather than less than breakeven) and there are limited funds available, is there any way to divert the TFTR program into CIT this year?

Answer: Due to the strong support which the TFTR D-T program provides for CIT, it would not be prudent to slow down or divert the TFTR D-T program funding in favor of CIT. The DT program in TFTR will confirm the satisfactory performance of tritium handling systems, qualify operational procedures for handling tritium safely, and begin to investigate alpha particle physics. This program is a fundamental step in systematically preparing for CIT construction and operation. The TFTR tritium systems will actually be reused on CIT. The Magnetic Fusion Advisory Committee, which reviewed the TFTR DT program, concluded that even at relatively modest performance levels TFTR would provide important experience in dealing with tritium and neutron activation that will directly benefit CIT. They also pointed out that, at performance levels nearer to breakeven, TFTR will provide the first preliminary information on alpha particle physics.

Question: Your testimony speaks of CIT as "utilizing the scientific personnel and infrastructure at Princeton Plasma Physics Laboratory (PPPL)." You further state "the CIT schedule should allow the facilities and personnel at PPPL . . . to be productively employed in addressing the important issue of understanding burning plasma physics." Do you foresee continued involvement in this project by the rest of the fusion community? If so, how do you think they will be involved 3 to 5 years from now?

Answer: Involvement of the rest of the fusion community in the project will continue through the life of the project. The CIT is a national project with many major fusion institutions participating in it. Their involvement at present includes the design and development of CIT systems and they will begin procurement of major CIT systems in FY 1989 and FY 1990. Since they are responsible for providing many of the CIT hardware systems, their level of involvement is expected to remain approximately constant throughout the construction phase, which extends to 1996. During the construction period, we also anticipate many universities and other contractors will be involved with developing and building CIT diagnostics. During CIT operations, scientists from throughout the U.S. and foreign fusion programs will undoubtedly participate in CIT experiments.

Tokamak Fusion Test Reactor

Question: Congress is very concerned about the clean-up of radioactive facilities. Is there any funding in your budget for clean-up of the TFTR site after the completion of DT operation?

Answer: Funding has been included in the 5-year budget recently submitted to Congress for anticipated TFTR decommissioning costs during this period. Decommissioning has always been considered a part of the DT program in TFTR; however, only preliminary planning has been carried out to date. Since the majority of the activation of TFTR will be due to isotopes with short half-lives, the most cost effective approach to decommissioning will involve a cooling off period prior to disassembly and disposal of the major tokamak components. In the meantime, TFTR subsystems will be restored or modified for future laboratory use wherever possible. With the DT experiments in TFTR scheduled to be completed in 1991, the Office of Fusion Energy has recently requested that Princeton Plasma Physics Laboratory begin detailed planning for the decommissioning of TFTR.

QUESTIONS SUBMITTED BY SENATOR MCCLURE

Boron Neutron Capture Therapy

Question: Have you any preliminary information on the substance of the NCI report? When is this report expected?

Answer: No Sir, we have not been provided any preliminary information from NCI. However, the NCI report is expected to be completed in April and should be available to Congress in May.

Research Reactors

Question: The Office of Energy Research operates a number of reactors at various national laboratories. Doesn't operation of these reactors create a conflict of interest with the research and development program you conduct? For aren't you the user and the provider of services?

Answer: Energy Research is indeed both a user and provider of reactor services. We do not provide support for a reactor unless we have needs for the services of that reactor. Rarely, however, are we the sole user or sole reactor operations funding source. During periods of fiscal stringency, there is strong competition between research and facility operations for available funds and when needs or research output no longer justify the operating expense, the facility is shut down. Examples of the latter happening are: the Oak Ridge Research Reactor which was shut down last year, the Argonne CP-5 reactor shut down in 1979 and the Ames Laboratory Research Reactor shut down in 1977. With regard to the High Flux Isotope Reactor at Oak Ridge and the High Flux Beam Reactor at Brookhaven, we make time available to other qualified users from industry and universities without charge if we have an interest in the proposed research. Thereby we acquire added return for our operation's investment - research we would otherwise not be able to afford.

Question: Please provide for the record each facility's budget, compared with those budgets requested by the national laboratories where the reactors are operated.

Answer: The comparison of the laboratory request versus the amount included in the FY 1989 President's budget is as follows:

	FY 1989 Laboratory Request	FY 1989 President's Budget
High Flux Isotope Reactor	$ 9.4	$ 17.8
High Flux Beam Reactor	13.5	12.8

The amount shown in the laboratory request column for the High Flux Isotope Reactor was prepared prior to the completion of the assessment of improvements needed for restart of the reactor. This request was later modified by the laboratory and was changed to the same amount as is now requested by the Department for FY 1989.

Question: Please provide percentage of funds the Office of Energy Research spends on safety improvements for these reactors compared to similar funding by commercial power plants?

Answer: We do not have information on the average expenditures for safety improvements at commercial power plants. We understand that they vary substantially each year at each plant. Money is spent on demand for new heat exchangers, pumps, valves, replacement piping, etc.

Similarly at the ER reactors, funds are budgeted for specific upgrades. For example, the beryllium reflector in the HFIR is replaced every seven years. The heat exchangers have been replaced at HFIR in the past five years. At the present time, about 50% of the funds provided for that reactor are used for safety assurances and upgrades. This is an unusual situation, the average for safety and maintenance is more nearly 30% but the swing is substantial.

Question: Please provide the number of professional staff in the Office of Energy Research specifically assigned to assure the safe operation of these reactors.

Answer: For FY 1987 the Office of Energy Research has dedicated the equivalent of some two man years to assuring the safe operation of its reactors. It should be noted, however, that consistent with the Department's policy of line responsibility for safety, these two man years represent part time inputs of a number of ER management and staff having programmatic responsibility for the reactors. In addition, ER used technical consultants to provide technical support and assistance in dealing with matters of reactor safety. As an example we asked Dr. Joseph Hendrie, past chairman of the Nuclear Regulatory Commission, to establish and chair an independent committee to evaluate for ER the technical work on the embrittled high flux isotope reactor to determine operational readiness of the reactor.

QUESTIONS SUBMITTED BY SENATOR INOUYE

Biofuels

Question: Over the past few years Hawaii has become a national leader for the conversion of biomass into methanol. What role can Hawaii play in assisting your program develop renewable alternatives to our looming transportation fuel problem?

Answer: Since Hawaii's initial involvement in the Biofuel's R&D program, the Department has worked closely with Hawaii researchers in coordinating R&D activities relevant to methanol production as well as other aspects of the Biofuels program. Hawaii's semi-tropical climate and long growing season are well suited to the rapid growth of biomass for energy purposes. In addition there are significant land resources and agricultural management capability available in the islands. The introduction of biomass-derived transportation fuels could benefit from the isolation provided by the individual islands that make up Hawaii. Such isolation results in limited travel distances and movement of automobiles among the islands. This can be advantageous in the acceptance of alternative transportation fuels due to reduced infrastructure requirements.

Hydrogen

Question: The national aerospace plane project of the Department of Defense and NASA appears to be progressing well. As you know, this next generation aircraft will be powered by hydrogen. It is my understanding that one of DOD's long term concerns is the availability of indigenously produced hydrogen when the plane becomes operational. What is the Department of Energy doing to work with DOD/NASA in providing for hydrogen fuel?

In this regard, I do note that the USDOE is providing funds to the Hawaii Natural Energy Institute on this subject. As this program must by its nature be continuous and extend over time, what steps are you taking to insure for continuity?

Answer: The Department is aware of the DOD/NASA efforts to develop the national aerospace planes. The Department's Hydrogen Energy Coordinating Committee has had presentations from NASA and DOE researchers as one means of staying abreast of developments. The development of technology bases for the production of hydrogen as well as for the national aerospace plane are long term efforts. The Department's hydrogen research program is focussed on the production of cost competitive hydrogen from low-cost materials such as water or biomass. Research in promising technologies for the production of hydrogen includes photochemical, biophotolytic, and advanced electrolysis technologies. As with any research undertaking of this nature, the Department continuously monitors and evaluates research efforts to ensure appropriate priorities are maintained and that research activities reflect National energy and other agency goals and are consistent with the need to control the Budget deficit.

Multi-Product OTEC

Question: The Seacoast Test Facility, located at Keahole Point on the Big Island of Hawaii has become the international test center for ocean resource technology. Your OTEC project with the Pacific International Center for High Technology Research (PICHTR) at this facility has shown tremendous progress over the past year. Can you please consider how this site can be made a national laboratory to coordinate ocean resource applications, particularly since the Exclusive Economic Zone declared by President Reagan in 1983 opens up the potential for seabed mineral R&D to also occur at this location. In addition, can you also provide details on how the partnership among the Solar Energy Research Institute, Argonne National Laboratory and PITCHTR is working out on OTEC research?

Answer: It is probable that PICHTR will gain increased national recognition after it has gone through a period of growth, maturation, and expansion of its expertise into additional areas of interest to the Pacific Basin countries. The increased seabed that is now within the limits of the Exclusive Economic Zone will provide opportunities for PICHTR to work with private sector organizations interested in exploiting such resources.

The cooperative arrangement existing between the Solar Energy Research Institute (SERI), Argonne National Laboratory (ANL), and PICHTR in OTEC research and development takes advantage of PICHTR's proximity to the ocean and the thermal resources required for exploitation of the OTEC concept. SERI and ANL provide the theoretical foundations for system design and fabrication of test fixtures. PICHTR now has the assignment for experimental verification and testing with seawater in several developmental areas. These areas of responsibility will increase in scope as the DOE OTEC effort utilizing the services of the three participants comes closer to operation of the 165 kWe (gross) experiment at the Natural Energy Laboratory of Hawaii.

Hawaii Deep Water Cable

Question: I understand laboratory testing of the Hawaii Deep Water Cable is proceeding on schedule and within budget; can you describe the current technical status of that laboratory program?

Answer: The laboratory test program of the Hawaii Deep Water Cable began in December 1987. The program's extensive set of electrical and mechanical tests is demonstrating that the cable is capable of withstanding the expected mechanical stresses and environmental conditions to be encountered during deployment, retrieval, and operation while retaining the electrical characteristics necessary for a service life of 30 years. The testing process establishes baseline electrical characteristics prior to the imposition of mechanical stresses. Subsequent individual and sequential tests simulate all mechanical stresses expected to be encountered during the cable's life. Final electrical testing will determine the effects of mechanical stresses upon the cable's electrical characteristics. To date, baseline electrical tests have been successfully completed. Equipment is being set up to conduct mechanical tests.

Question: The procurement of a vessel and equipment for at-sea testing remains one of the larger cost components of work still to be done under the Hawaii Deep Water Cable program; has the program made any effort to reduce the uncertainty of costs related to that procurement?

Answer: The prime contractor, Hawaiian Electric Company, is planning to lease a vessel and outfit it to include the highly specialized cable laying equipment required for the at-sea test. Leasing and modification of the vessel were estimated to be approximately 50-60% of the at-sea test costs. In order to reduce uncertainty in costs, bids were sought in November 1987. Negotiations are underway with the apparent low bidder to secure the attractive bid ($3.4 million), which is nearly the same as the estimated costs.

Question: I am aware of several projects involving submarine cable transmission that are in the planning or design stages; these include Nova Scotia Power Company's connection to Boston Edison, Middle South Utilities' link to Florida Power & Light, and the proposed 600 mile system tying Iceland's hydropower resources into the United Kingdom grid. Have there been contacts between the Hawaii Deep Water Cable program and each of these projects and how might the research in Hawaii be of benefit?

Answer: Representatives from each of the projects have met with Hawaii Deep Water Cable researchers to discuss significant problems associated with their projects. The three cable projects mentioned above involve difficult conditions, such as extreme depths, long distance transmission, and high currents, for installing and maintaining underwater transmission systems. They have been encouraged by the successful Hawaii Deep Water Cable (HDWC) research providing solutions for installing and maintaining underwater power cables in the unprecedented conditions encountered in crossing the Alenuihaha Channel. These meetings have resulted in significant technology transfer. For example, consultants for the Nova Scotia Power Company have met with researchers on the HDWC and are using information received to assist in planning the project. Consultants for the Florida Power and Light Company are interested in using the HDWC three dimensional cable installation model; they expect to encounter high currents in the crossing from the Grand Bahamas to Florida. A detailed study (February 1988) issued by

Iceland references the HDWC work and concludes that a submarine cable connection between Iceland and the United Kingdom is feasible and should be pursued.

Question: It is my understanding that significant strides have been taken within the last year toward commercial application of this research in Hawaii; would you please discuss these recent activities and the role of the Hawaii Deep Water Cable program in their development.

Answer: Governor Waihee of Hawaii last summer appointed an Advisory Board headed by former Governor Will Quinn, to determine the commercial feasibility of a geothermal generating system on the island of Hawaii providing 500 MW to Oahu via a deep water cable system. Five major international submarine cable manufacturers were invited to brief the Committee last November, and without exception they believed that the HDWC research would be successful and that a commercial underwater cable system be shown to be feasible. In a report issued in January 1988, the Advisory Board concluded that the geothermal generation and cable system is a sound commercial venture. As a result, legislation has been introduced to consolidate the permits for both the geothermal plants and the deep water cable system and to appropriate funding for exploratory drilling on the Big Island to confirm the extent of the geothermal resource.

The Department hopes that the expressed confidence of the private sector in the commercial viability of this project will translate into increased private sector financial commitment.

SUBCOMMITTEE RECESS

Senator McClure. If there is nothing further to come before the committee at this time, the committee will stand in recess until Friday, March 18, at 10 a.m., when we will continue hearings on DOE's 1989 budget.

Thank you very much for your appearance and your testimony.

[Whereupon, at 11:28 a.m. Tuesday, March 15, the subcommittee was recessed to reconvene at 10 a.m. Friday, March 18.]

ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1989

FRIDAY, MARCH 25, 1988

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 10:09 a.m. in room SD–116, Dirksen Senate Office Building, Hon. J. Bennett Johnston (chairman) presiding.

Present: Senators Johnston, Burdick, Sasser, DeConcini, Hatfield, McClure, Dominici, and Specter.

DEPARTMENT OF ENERGY

ATOMIC ENERGY DEFENSE ACTIVITIES

STATEMENT OF TROY E. WADE II, ACTING ASSISTANT SECRETARY FOR DEFENSE PROGRAMS, DEPARTMENT OF ENERGY

ACCOMPANIED BY:

- GEN. PAUL F. KAVANAUGH, DEPUTY ASSISTANT SECRETARY FOR MILITARY APPLICATION, DEPARTMENT OF ENERGY
- MS. JILL E. LYTLE, DEPUTY ASSISTANT SECRETARY FOR NUCLEAR MATERIALS, DEPARTMENT OF ENERGY
- DR. CHARLES F. GILBERT, ACTING DEPUTY ASSISTANT SECRETARY FOR SECURITY AFFAIRS, DEPARTMENT OF ENERGY
- JAMES W. CULPEPPER, DEPUTY ASSISTANT SECRETARY FOR PLANNING AND RESOURCE MANAGEMENT, DEPARTMENT OF ENERGY

Senator JOHNSTON. Good morning. The hearing will come to order.

Our witnesses this morning are Troy Wade, Acting Assistant Secretary for Defense Programs, from the Department of Energy; and Dr. Robert Barker, Assistant to the Secretary of Defense for Atomic Energy, of the Department of Defense, who will present testimony of the fiscal 1989 budget request for Atomic Energy Defense Activities.

Mr. Wade, please proceed. We are glad to have you this morning.

Mr. WADE. Thank you, Mr. Chairman. It is a pleasure, as always, to be here.

In the audience are four of my principals: James Culpepper, Deputy Assistant Secretary for Planning and Resource Management; Gen. Paul Kavanaugh, who is Deputy Assistant Secretary for Military Application; Jill Lytle, Acting Deputy Assistant Secretary for Nuclear Materials; and Charles Gilbert, Acting Deputy Assistant Secretary for Security Affairs. All except Mr. Culpepper will have detailed written statements, and with your permission, we would like to have them all inserted for the record.

Senator Johnston. Yes, without objection, those statements will be placed at the appropriate place in the record.

[Note: The prepared statements referred to appear at the end of the hearing record.]

SUMMARY OF STATEMENT

Mr. Wade. I will summarize my statement.

I am here today to talk about the defense programs part of the Atomic Energy Defense Activities budget. My request is $7.5 billion of the total $8.1 billion.

I would like to begin, Mr. Chairman, by just saying a couple of words about philosophy.

UNIQUE CAPABILITY FOR THE NATION

The system by which we manage the nuclear weapons program, as you all know, was established on the principle that a dual-agency approach between DOD and DOE would provide the necessary checks and balances. We continue to believe that the dual-agency approach serves the nation well. That principle has been maintained, verified, and endorsed by every administration and Congress since 1946.

With this committee's support, the Department has played an important role in assuring an effective nuclear deterrent. We have done that by meeting the Department of Defense requirements for nuclear weapons, improving the quality and reliability of the stockpile, and introducing safer and more secure weapons.

We have a unique technical capability at the DOE laboratories and in the DOE industrial complex. We hope that the nuclear competence of those laboratories and of that industrial complex can continue to be maintained.

DEFENSE PROGRAMS MISSIONS

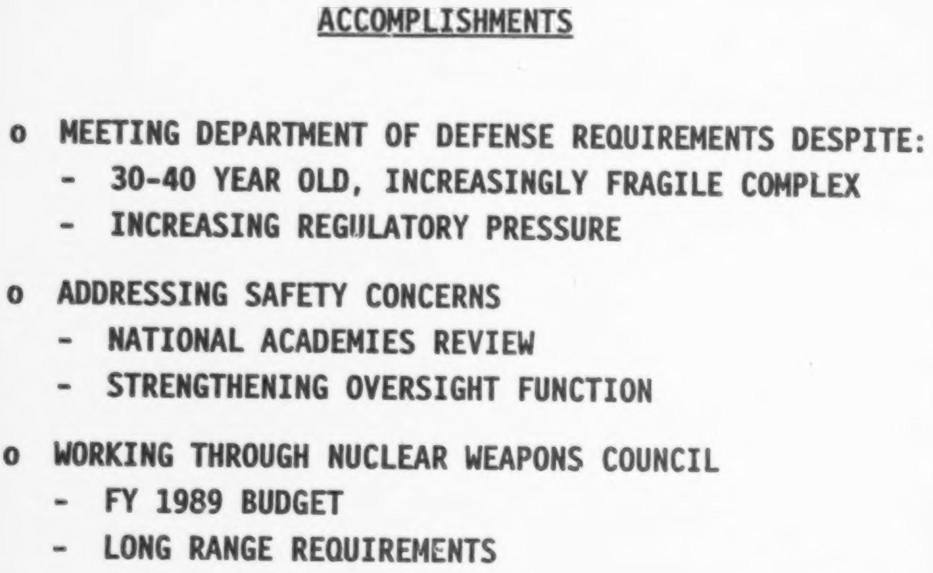
o SUPPORT NATIONAL SECURITY POLICIES OF THE UNITED STATES FOR A NUCLEAR DETERRENT

o PROVIDE SAFEGUARDS AND SECURITY FOR NUCLEAR WEAPONS, DEVICES, MATERIALS, FACILITIES, AND INFORMATION UNDER DOE CONTROL

o PROVIDE SAFE, HEALTHFUL, AND ENVIRONMENTALLY ACCEPTABLE OPERATIONS OF DOE-OWNED FACILITIES UNDER DEFENSE PROGRAMS CONTROL

MISSIONS

I want to remind the committee of the missions of defense programs. First and foremost is to support the national security policy of the Nation; to do that while developing and maintaining a research, development, and test capability; to produce parts in nuclear materials for the weapons that we assemble; to process the waste generated from those efforts; and to assist other agencies in determining our adversaries' capability in compliance with treaties through verification and arms control. Of course, overlaying the primary mission is providing for adequate security and operating our facilities in a safe, healthful, and environmentally acceptable manner.



ACCOMPLISHMENTS

- o MEETING DEPARTMENT OF DEFENSE REQUIREMENTS DESPITE:
  - 30-40 YEAR OLD, INCREASINGLY FRAGILE COMPLEX
  - INCREASING REGULATORY PRESSURE
- o ADDRESSING SAFETY CONCERNS
  - NATIONAL ACADEMIES REVIEW
  - STRENGTHENING OVERSIGHT FUNCTION
- o WORKING THROUGH NUCLEAR WEAPONS COUNCIL
  - FY 1989 BUDGET
  - LONG RANGE REQUIREMENTS

ACCOMPLISHMENTS

I think we have done a good job in accomplishing our mission. These are the kinds of accomplishments that we achieved over the past year. We have met the Department's requirements, despite stretching to the limit the 30- to 40-year-old complex that we are running, and we have done so under increasing regulatory pressures.

We have addressed several new safety issues in the last year, brought on, in large part, by the National Academy of Sciences safety review that Secretary Herrington requested. You will hear more about that a little later on. We have actively utilized the Nuclear Weapons Council this year, working with the Department of Defense under the Council's umbrella after the 1989 budget summit to come up with a proper balance of the 050 account.

CURRENT AGENDA

This is my agenda for the balance of fiscal year 1988 and for fiscal year 1989, along with this budget request.

CURRENT AGENDA

- o DEVELOPING MODERNIZATION PLAN
- o PROCEEDING WITH NEW PRODUCTION REACTOR ACQUISITION
- o SUPPORTING DEPLOYMENT OF SPECIAL ISOTOPE SEPARATION TECHNOLOGY
- o UPGRADE COMPLEX FOR REGULATORY/SAFETY NEEDS
- o SUPPORT ARMS CONTROL INITIATIVES
- o TECHNOLOGY TRANSFER

We are developing a modernization plan, as requested by Congress. Taking into account the Department of Defense requirements, we hope to send the Congress a road map in December that will show us what this Nation's nuclear deterrent capability needs will be into the next century. It is probably one of the most important undertakings of defense programs in a good number of years.

We are proceeding with the acquisition of new production reactor capacity. We have in place a departmental plan which will identify a reactor technology, or technologies, and a reference site later on this summer which would allow us to proceed with the required environmental impact statement, for a new reactor, hopefully, beginning construction of that most important facility in fiscal year 1990.

We continue to support the deployment of the special isotope separation technology as a mid-1990's source of plutonium for weapons requirements. Our budget request includes continuing SIS. We will complete the EIS on the special isotope separation facility later this year and hope to move to construction next year.

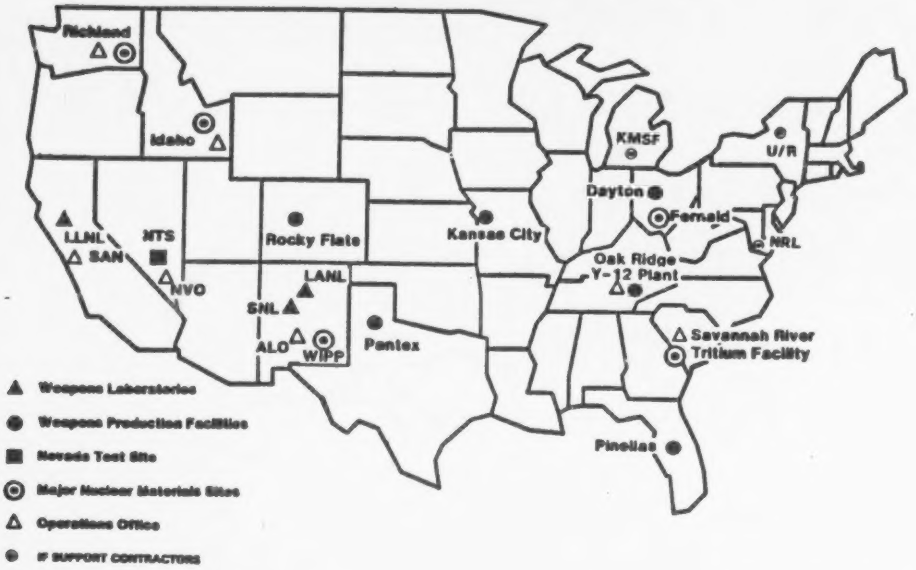
We continue to upgrade our complex to meet the increasing regulatory requirements. I will speak more about those later. We are playing a major role in the arms control initiatives of this Nation, both directly with respect to the verification of the nuclear testing treaties, as well as providing major support to other agencies of the government in all the treaty verification R&D that is necessary for verifying things like the Strategic Arms Treaty.

Finally, we have a major initiative to provide the proper balance of technology transfer from the laboratories to industry. It is a delicate balance. We must protect the information and the weapons that are required by the Atomic Energy Act, but we also must find a way to properly transfer laboratory-developed technology to the private sector and we are doing that.

WEAPONS AND NUCLEAR MATERIALS SITES

Just a quick reminder to the committee of the size of this complex.

WEAPONS DEVELOPMENT, TESTING AND PRODUCTION AND NUCLEAR MATERIALS SITES


Richland
Idaho
LLNL
SAN
NTS
NVO
Rocky Flats
LANL
SNL
ALO
WIPP
Pantex
Kansas City
KMSF
Dayton
Fernald
Oak Ridge
Y-12 Plant
U/R
NRL
Savannah River
Tritium Facility
Pinellas
▲ Weapons Laboratories
● Weapons Production Facilities
■ Nevada Test Site
◎ Major Nuclear Materials Sites
△ Operations Office
● IF SUPPORT CONTRACTORS

This chart shows the weapons laboratories, the production facilities which run from one coast to the other, and our one and only nuclear test site in Nevada. It includes the inertial confinement fusion support facilities at the University of Rochester, as well as the Department of Energy's operation offices. Altogether, this represents about 65,000 contractor personnel around the United States.

SIGNIFICANT ELEMENTS

Our fiscal year 1989 request includes, but certainly is not limited to, these following significant elements. We will support the DOD nuclear weapons requirements. Dr. Barker will address those in detail following my presentation.

The budget does reduce laboratory employment by about 350 people. It also reduces slightly the nuclear testing level, and I will describe those in a little more detail. It maintains a level of effort in our nuclear directed energy weapons programs and in our inertial fusion program.

The budget request allows us to move ahead with new production capacity. It allows us to address the environment, safety, and health concerns. We will operate three production reactors, moving from four to three by placing the N Reactor at Hanford in cold standby. The budget supports intensified arms control activities.

In addition, we will continue with our major waste disposal activities.

PROGRAMS SUPPORTED

(New Production)

- ✓ TRIDENT II (W88)
- ✓ MODERN ARTILLERY PROJECTILE (W82)
- ✓ SRAM II (W89)
- ✓ NUCLEAR DEPTH/ STRIKE BOMB
- ✓ RAIL-BASED PEACEKEEPER (W87) *
- ✓ FOLLOW-ON TO LANCE *

** FOR PLANNING ONLY*

PROGRAMS SUPPORTED

(Continuing Builds)

- ✓ MODERN TACTICAL BOMBS (B61-3/4)
- ✓ CRUISE MISSILE WARHEADS (W80s)
- ✓ MODERN STRATEGIC BOMB (B83)
- ✓ SILO-BASED PEACEKEEPER (W87)
- ✓ STOCKPILE MODERNIZATION (B61)

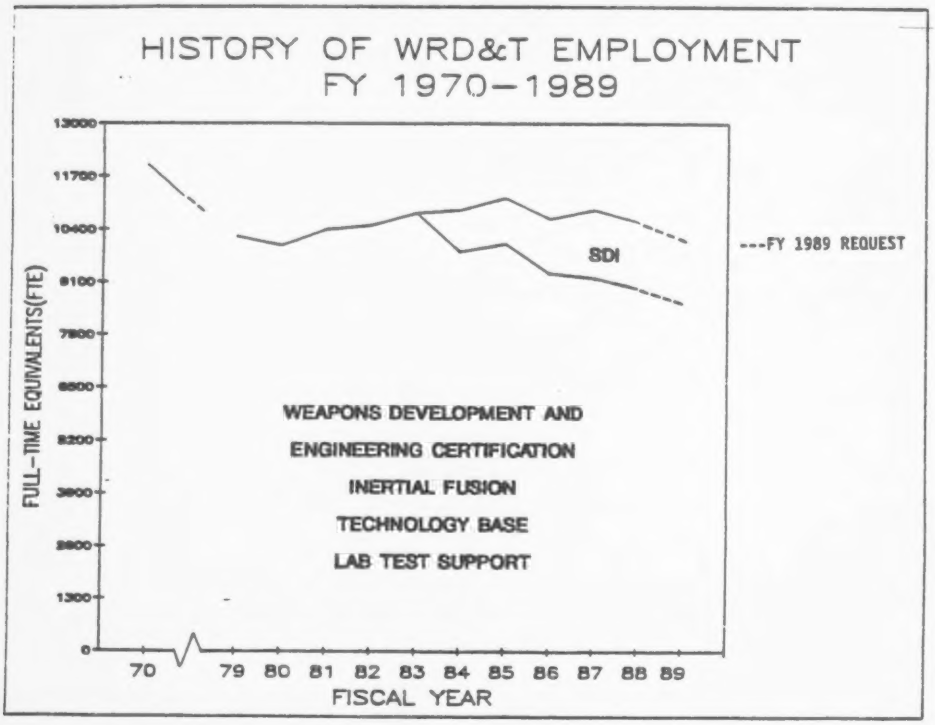
NEW WEAPONS PRODUCTION AND BUILDS

These are the new production programs supported in our 1989 budget request. This will be the first year of major Trident II W88 production. We will continue with the W82 modern artillery first projectile, SRAM II, and so on. Some of those are not totally defined yet.

These are builds that we will support during the budget year: the B–61, 3 and 4, the cruise missile warheads, and the modern strategic bomb. In addition, we will continue with our very important stockpile modernization program.

EMPLOYMENT HISTORY

This is the history of our RD&T employment. This set of curves reflects the continuing downward trend in laboratory employment.



RD&T laboratory employment in fiscal year 1988 is about 10,600. This budget request will take it down to about 10,250. That is a reduction of about 5 percent in the core program.

During our modernization study, a very important element will be to try to determine precisely what the laboratory strength needs to be as we move into the next century so that we can prevent, where possible, up and down employment perturbations.

TESTING

We have a similar concern about the number of nuclear tests. This shows the number of nuclear tests over time. It has declined since 1983, and our fiscal year 1989 request continues that decline.

Based upon studies requested by Congress and our own concerns, we are also evaluating to determine the number of tests needed over the next decade to assure that we can maintain the nuclear competency of this Nation in light of all the arms control initiatives.

PLUTONIUM DEMAND

A very important issue is plutonium demand. This chart shows the reduction in demand, as agreed upon with the Department of Defense. Dr. Barker's presentation will amplify on why the requirements did change.

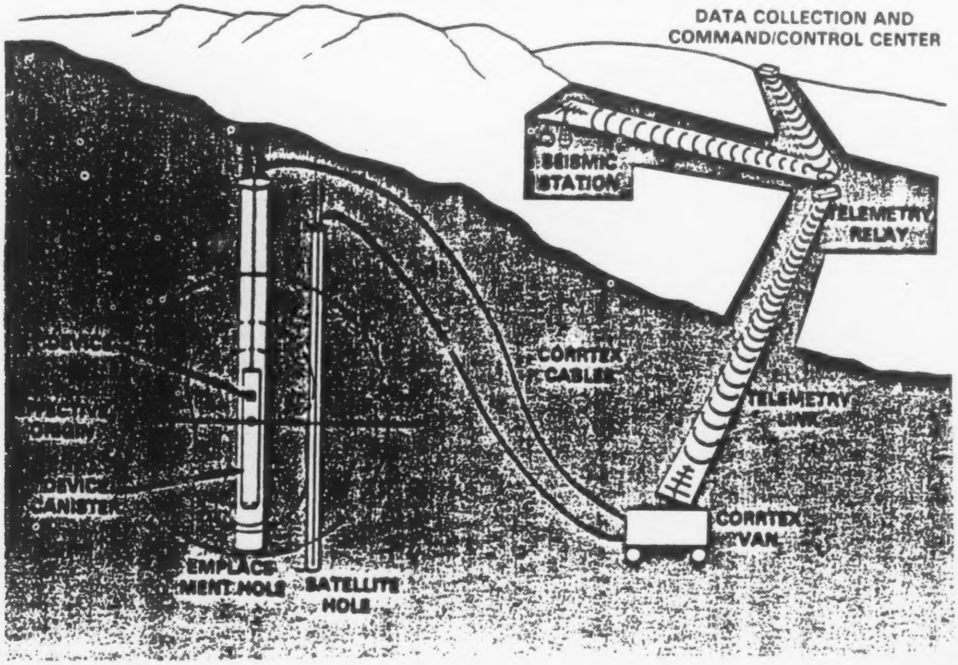
The top line shows the plutonium requirements as we saw them prior to the budget summit, and the bottom line shows the plutonium demand as we see it now. This reduction allowed us to place N Reactor in cold standby.

With regard to N Reactor, we are completing the safety enhancement program that had been ongoing for the better part of a year, such that in a national emergency we can restart the reactor in 2 to 3 years, if required. We believe it is a very prudent insurance policy to do that.

VERIFICATION ACTIVITIES

In arms control, as I mentioned, we are playing a major role and particularly with regard to nuclear testing. This is a picture of a hydrodynamic yield verification system developed by Los Alamos, called CORRTEX.

CORRTEX SYSTEM DEPLOYED FOR USE IN SATELLITE HOLES


DATA COLLECTION AND COMMAND/CONTROL CENTER
SEISMIC STATION
TELEMETRY RELAY
DEVICE
CORRTEX CABLES
TELEMETRY LINK
FFECTIVE ORIGIN
DEVICE CANISTER
CORRTEX VAN
EMPLACEMENT HOLE
SATELLITE HOLE

This is what we will take to the Soviet test site in fiscal year 1988 and use to measure the yield of a Soviet test. Information gained from that will allow us to negotiate with the Soviet Union adequate verification protocol, such that we would have the right to go to the Soviet Union to instrument a test to assure that they were in compliance with the Threshold Test Ban Treaty. This is a very important step forward in arms control and in verifiction.

FISCAL YEAR 1989 BUDGET REQUEST

This is the fiscal year 1989 congressional request for defense programs in the four major categories. The request is $7.470 billion. That reflects an increase of aout 5 percent over the fiscal year 1988 appropriation.

FY 1989 CONGRESSIONAL REQUEST
($ IN MILLIONS)

	FY 1987	FY 1988	FY 1989 REQUEST
WEAPONS ACTIVITIES	$ 4,163	$ 4,207	$ 4,257
NUCLEAR MATERIALS PRODUCTION	1,848	1,809	2,017
DEFENSE WASTE AND ENVIRONMENTAL RESTORATION	702	895	936
SECURITY AFFAIRS	194	231	260
TOTAL DEFENSE PROGRAMS	$ 6,907	$ 7,142	$ 7,470
			+4.5%
% OF 050 ACCOUNT	2.4%	2.4%	2.5%

You will notice that a significant part of that increase is in the nuclear materials production line, which represents not only the new production reactor activities and the special isotope separation activities, but $88 million worth of additional safety improvements for the three Savannah River reactors.

You will also note an increase in the defense waste area which reflects moving from construction to operation at two major facilities of which we are very proud: the waste isolation pilot plant in New Mexico, which will begin operation later on this fall, and the defense waste processing facility at Savannah River, which will come on line in fiscal year 1990

SAFEGUARDS AND SECURITY CROSSCUT

Safeguards and security have been a very important part of our activities over the past few years. It has been of great interest to this committee and others. This is the crosscut safeguards and security budget in my fiscal year 1989 request.

DEFENSE PROGRAMS
SAFEGUARDS AND SECURITY ACTIVITIES
FY 1989 CROSSCUT BUDGET ESTIMATE
($ IN MILLIONS)

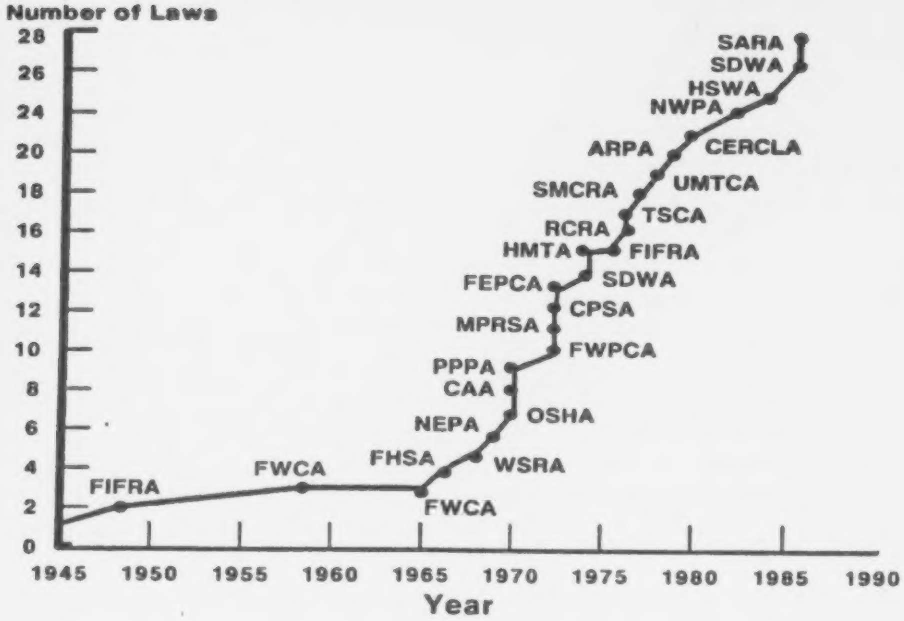
	FY 1987	FY 1988	FY 1989 REQUEST
OPERATING EXPENSE	$ 516	$ 555	$ 581
CAPITAL EQUIPMENT	37	38	37
CONSTRUCTION	104	110	87
TOTAL	$ 657	$ 703	$ 705

I would call to the chairman's attention that the budget is essentially level. We believe that we have brought, from a security point of view, our complex into state-of-the-art kind of requirements. We believe that now we can level this particular budget line out.

ENVIRONMENTAL LEGISLATION

This chart is one that the committee has seen before, and I show this just to point out the numbers of new kinds of environmental legislation that has been brought on line over the past very few years. The effect of that on us is reflected in the ES&H line of our budget request, which is growing rather dramatically.

ENVIRONMENTAL LEGISLATION



PRODUCTION ASSURANCE/
ENVIRONMENTAL SAFETY AND HEALTH FUNDING
FY 1989 CROSSCUT BUDGET ESTIMATE
($ IN MILLIONS)

	FY 1987	FY 1988	FY 1989 REQUEST
OPERATING EXPENSE	$485	$568	$792
CAPITAL EQUIPMENT	33	38	55
CONSTRUCTION	133	135	173
TOTAL	$651	$741	$1020
ENVIRONMENTAL COMPLIANCE AND PROTECTION	$383	$472	$574
HEALTH AND SAFETY	268	269	446
TOTAL	$651	$741	$1020

ENVIRONMENTAL AND HEALTH FUNDING

I show the request, which is over $1 billion, in two different pieces here. Above the line is that billion dollars broken into operating, capital equipment, and construction. Below the line I have broken it a different way, showing which portion of the budget goes for environmental compliance, in many cases meeting state and EPA requirements and regulations so that we can continue to operate.

Finally, this depicts which portion of the budget goes for health and safety, including the upgrades of our reactor facilities.

SUMMARY

In summary, the budget summit agreement significantly constrained the entire national defense account, including our part of the 050 account. Within that agreement, DOD requirements were reduced, which allowed us to take certain steps regarding our ability to provide nuclear material. It is very clear that the new production reactor capacity is urgently needed. It is going to be very difficult to fund it in the coming years within a Defense-related budget which we believe is going to grow 2 to 3 percent per year. Major new facilities like that cannot be accommodated within that kind of an increase.

In addition to operating an aging facility, we need to continue to restore the complex and continue to meet the new ES&H requirements as we do this modernization study and chart the course for the future.

Coming up with the nuclear weapons complex of the future is a prudent course for the Nation to take, but it does mean, in any case, that we will continue to have to operate some very old facilities for a good number of years.

We certainly appreciate this committee's support, and we solicit your support for this request as we move out into the future.

That concludes my summary, Mr. Chairman.

Senator JOHNSTON. Thank you very much.

[The statement follows:]

STATEMENT OF TROY E. WADE II, ACTING ASSISTANT SECRETARY FOR DEFENSE PROGRAMS, DEPARTMENT OF ENERGY

INTRODUCTION

I am pleased to appear before the Committee to discuss important issues facing the Nation and this Department concerning nuclear weapons technology capabilities, and to present the Department of Energy's FY 1989 appropriations request for Atomic Energy Defense Activities.

The system for managing the nuclear weapons program was established by the Congress more than forty years ago, based on the principle that an independent, civilian-controlled program would assure the most effective design, development, production, and ensured reliability of nuclear weapons to meet national security needs. In addition, a dual-agency approach would provide the necessary checks-and-balances for assuring the best possible nuclear weapons stockpile while providing the appropriate safety, security, and use-control of nuclear weapons. That principle has been maintained, verified, and endorsed by every Administration and Congress since the 1946 enactment of the Atomic Energy Act.

With this Committee's support, the Department of Energy has played an important role in assuring an effective nuclear deterrent responsive to national security objectives. We have met our mission objectives (Chart 1). During the 1980's, the DOE has been a key player in the Administration's Strategic Modernization Program and has met Department of Defense requirements for nuclear weapons. We have improved the quality and reliability of the nuclear stockpile. We have introduced safer and more secure weapons. We also continue to support advanced technologies and concepts such as the Strategic Defense Initiative and Inertial Fusion for future needs. To accomplish this, the DOE has been required to bring a substantial number of initiatives and facilities on line to provide the necessary technology, components, and materials. At the same time, we have significantly improved the security, safety, and environmental protection of our facilities.

UNIQUE CAPABILITY FOR THE NATION

By statute and by design, the DOE provides the technical capability and industrial capacity directed specifically to nuclear weapons and related technologies that have served the Nation so well for many years.

This includes the management of an aggressive and vibrant research, development, and test program consisting of three national laboratories. The prime mission of these laboratories is to support national security through nuclear weapons design and development. The cornerstone of their efforts continues to be the maintenance of a healthy capability for the necessary design, development, testing, production engineering, and nuclear stockpile surveillance to assure a credible nuclear deterrent. The laboratories also maintain the technology that allows us to meet our "dual agency" responsibility for assessing the safety, security, and use control of nuclear weapons. In addition to those fundamental responsibilities, significant efforts are focused on maintaining a technology base sufficient to sustain a capability for assessing evolving threats, to support future flexible response to DOD requirements, and to avoid technological surprise that could provide an adversary a significant advantage. Finally, the laboratories serve as a unique resource for supporting the Strategic Defense Initiative, determining the feasibility of Inertial Fusion, developing laser isotope separation processes, and researching advanced technologies for improving conventional munitions.

We also maintain the infrastructure to produce the weapons developed by the national laboratories. This includes 1) a base of nuclear reactors and supporting fuel, processing, and waste handling facilities to provide plutonium, tritium, and uranium materials; 2) weapons production facilities to produce the unique technology and quality components, and assemble them into nuclear warheads, and to continue quality and reliability testing over the life of the weapon; and 3) facilities to manage and ultimately dispose of wastes generated from those nuclear material and weapon production processes.

WHAT'S ON THE HORIZON?

The Administration has been successful in negotiating the Intermediate-Range Nuclear Force reduction treaty and is continuing discussions towards further arms reduction initiatives. This has brought pressure from some to reduce -- unilaterally and immediately -- our program efforts to support current and future national security policy objectives. In the near-term, however, our country must continue to assure its national security, with nuclear weapons serving as major factors in our defense posture. As long as the Nation's policy objectives include nuclear deterrence, the DOE must maintain nuclear competence throughout the complex.

This competence must be preserved, because it exists nowhere else in the United States and it cannot be readily restored if any of its major components are degraded or eliminated. The capabilities of our nuclear weapons laboratories and the production complex are national assets. The mere preservation of their capabilities has a deterrent value as do the actual warheads in stockpile. Competence must be maintained through experienced scientists, engineers, and technicians in our laboratories and production complex, who are provided with the best equipment and technology to remain in the forefront of their fields. Testing is essential in any experimental program, and in the case of nuclear weapons research, underground nuclear testing is required to obtain the necessary data that cannot be obtained in a laboratory setting. Simply stated, nuclear competence includes experienced people, the necessary equipment and technology, and testing capabilities.

Many of our facilities are near the end of their useful life. In the case of our reactors, particularly, we need to reinforce efforts to provide for nuclear material supplies during the next decade until new production reactor capability becomes operational. We need to deploy new capabilities such as modern reactors, laser isotope separation processes and improved residue recovery techniques. In addition, many of the weapons in stockpile also are near the end of their design life. We need to continue efforts to modernize those weapons to assure the most safe and secure stockpile possible. In short, DOE needs to modernize its existing facilities and capabilities and the weapons stockpile to be responsive to national security requirements -- both weapons and technologies -- into the next century.

Our current activities are carried out in a large and intricate network of production and laboratory facilities spread across the Nation (Chart 2). To assist us in planning for the future, we have a major study underway to develop recommendations concerning the appropriate size and productive capacity of the nuclear weapons complex. We must assure that we maintain competence and the capability to avoid technological surprise while balancing capacity with realistic workload requirements placed on us by the Department of Defense. The scope of this study spans all facets of our operations, from the national laboratories through the production complex. We expect to provide the study and recommendations to the Congress late this year.

While meeting production requirements, we have a fundamental responsibility to assure that our facilities and production processes protect the environment and the public health and safety. In addition, because we deal with nuclear weapons and other sensitive national security issues, we must maintain a high degree of security for our facilities. We have made significant progress in these areas -- from instituting technical safety appraisals and environmental protection plans and strategies to developing master safeguards and security agreements for our most sensitive facilities and updating safeguards and security policy. We still have changes and improvements to make, but we have an aggressive program in place to make sure we get there.

We fully support the Administration's efforts to bring the Federal deficit under control. The deficit reduction measures recently concluded through the

Budget Summit Agreement suggest limited funding within the total national defense function, now and in the future. There will be increased competition for the limited funding to accomplish all of the things we are required to do. It is clear, however, that in the future, the DOE cannot accommodate the requirements for our base activities and for the new production reactor or highly enriched uranium metal for weapons, if needed, with our current share of the national defense function.

Finally, managing such a diverse and large complex requires special skills to balance programmatic needs, environment, safety and health, quality assurance, and security requirements. We believe this can be done through a process that allows for practical, realistic, and cost-effective oversight. One initiative taken is to establish an independent advisory board to look at nuclear safety issues. The board will report directly to the Secretary of Energy. In addition, the National Academy of Sciences has and will continue to provide independent reviews of our operations. We will not operate existing facilities nor build new facilities if we cannot assure ourselves, you, and the public that they can be operated within acceptable risk in a safe, secure, and environmentally acceptable manner.

HARD CHOICES

In working with the Department of Defense through the Nuclear Weapons Council, we were faced with three difficult options to balance program needs with funding -- 1) reallocation of resources within the national defense function; 2) reductions in nuclear weapons; or 3) delays in schedule to assure the long-term viability and capability of the nuclear weapons complex to meet future national security objectives and to address regulatory requirements directed at its facilities. In the end, we made decisions that exercise all three available options.

The hard choices impacted all facets of our operations, including the laboratories and the weapons and materials production complexes. By accepting balanced lower levels of activity in the short-term, we were better able to posture ourselves to meet future DOD needs. We need to look at the long haul for our unique capabilities.

To that end, the Department will fully support actions necessary to bring new production reactor capability into operation by 1999. This replacement facility is required to assure well into the next century that the nuclear weapons stockpile will remain a credible deterrent. We also will deploy new, more efficient technologies and production processes with construction of a laser isotope separation process and improved residue recovery facilities.

We will meet Department of Defense requirements for the nuclear weapons stockpile, even though we will place the N-reactor at Richland into a cold-standby status. This action will allow us to conduct other critical activities within our current share of the national defense function. We will, however, complete those parts of the N-Reactor safety enhancement program that would have been required for startup and power operation prior to placing it into standby. This will make its output available should it be necessary in the future. We can meet DOD requirements through recycle of material from retirements, reprocessing existing inventories, and operating the three remaining reactors at Savannah River.

FISCAL SUPPORT

The President's FY 1989 appropriations request of $8.1 billion for Atomic Energy Defense Activities represents a balance resulting from hard choices and keeps us on our critical path (Chart 3). It supports the requirements for the Naval Reactors program, which will be briefed separately by Admiral McKee, with a request of $0.6 billion. It also supports nuclear weapon requirements of the Department of Defense, continues activities associated with new production reactor capability and eventual operation of the special isotope separation process, initiates improvements in residue recovery techniques, continues efforts to stabilize and dispose of defense-related waste, and pursues continued security, safety, and environmental protection measures.

We are requesting a funding level of $7.5 billion for DOE Defense Programs. This allows an increase of $328 million, or approximately 5 percent over FY 1988. This represents our share of the overall national defense function ceiling of $299.5 billion. This increase (Chart 4) goes primarily to New Production Reactor support, implementation of National Academy of Science recommendations, increased environmental activities, facility upgrades, our plans for joint verification experiments with the Soviets, and the cost of continuing to do business in support of the Department of Defense.

OUR COMMITMENT TO NATIONAL SECURITY

Weapons Research, Development, and Testing

In the Weapons Research, Development, and Testing (RD&T) program (Chart 5), we will support the Department of Defense requirements for new systems, and maintain the technology base to support both the current stockpile and the stockpile of the future. There is a reduction, about 5 percent, in our core laboratory RD&T employment (Chart 6), but we will maintain the FY 1988 level of effort for our Nuclear-Directed Energy Weapons and Inertial Fusion programs.

Our Nuclear-Directed Energy Weapons program will continue to define the threat to proposed non-nuclear strategic defense initiative (SDI) architectures; to determine the threat to the current nuclear deterrent; and to determine the feasibility of nuclear directed energy weapons as an SDI option, if necessary. With the funding requested, we expect to provide the Department of Defense with an assessment of technical feasibility of three nuclear-directed energy concepts (X-ray laser, hypervelocity pellets, and optical frequency laser) by the late 1990's. The Inertial Fusion program continues to explore the ability to simulate certain nuclear weapons explosive processes and to enhance our predictive capability. The capabilities of our nuclear weapons laboratories are being supplemented by three major contractors: KMS Fusion, Inc.; the University of Rochester; and the Naval Research Laboratory. Chart 7 shows the OMEGA laser at the University of Rochester--the principal direct-drive inertial fusion facility in the United States.

An integral component of the research and development program is our testing activity. We must continue to test in order to support research to avoid technological surprise, conduct development programs for new weapons to address changing threats, and to maintain our existing weapons stockpile. We are showing a slight reduction in our weapons testing (Chart 8) as compared to prior years. However, our position is that we must sustain a testing level necessary to assure that the current and future nuclear weapons stockpile continues to be a reliable and an effective nuclear deterrent.

Weapons Production and Surveillance

The Weapons Production and Surveillance program supports the fabrication and assembly of nuclear weapons and weapon components, and stockpile maintenance and reliability assessment. Consistent with our agreement with the Department of Defense, we will produce *Deleted* weapons in FY 1989 and will support an infrastructure to build *Deleted* weapons per year in the outyears. Six different weapons systems (Chart 9) will be delivered or modified in FY 1989. We are programmed to retire *Deleted* weapons during FY 1989. Particularly noteworthy is the Poseidon retirement

Deleted

Deleted

All of these actions, taken in this era of budget constraint, will allow us to conduct defense programs within a resized complex.

We are strongly committed to continuing the long-term priority effort to maintain and modernize our production plants. This complex of aging production facilities and assembly plants is faced with severe production pressures trying to meet operational schedules. Our budget (Chart 10) will support the production of weapons and most urgent restoration and maintenance activities. We must ensure our facilities have the capability and capacity to meet production schedules, and in doing so, operate in a safe, secure and environmentally acceptable manner. The budget request includes a new initiative to upgrade Building 371 (Chart 11) at our Rocky Flats Plant. Building 371 was built as a replacement to the aging plutonium recovery facilities at Rocky Flats and has failed to operate as intended and requires extensive modification. Building 371 is a fully hardened facility and is capable of meeting all current environment, safety and health; and safeguards and security criteria. The upgrade will provide a safe, efficient, and economic recovery capability for plutonium from weapon returns and production residues. Numerous studies have shown this course of action to be the most logical, cost effective method to providing a replacement to plutonium recovery operations at Rocky Flats.

Nuclear Materials Production

As mentioned earlier, we are placing N Reactor in cold standby because of budget constraints which led to revised production requirements from the Department of Defense. N Reactor has operated since 1963, producing plutonium for both defense and reactor research and development purposes, as well as byproduct steam for the generation of electricity. This reactor has played a key role in meeting the requirements for plutonium. However, the reduced requirements now forecast by the Department of Defense can be met by our Savannah River reactors and by recycling retired nuclear weapons and residue material. Placing N Reactor in cold standby is the most prudent response to these changes. We will, however, complete those parts of the N Reactor safety enhancement program that would have been required for restart and power operation prior to placing it in standby. This will make its output available should it be necessary in the future. As a contingency in the near term, we have a plan to accelerate the processing of plutonium residues to provide the necessary material should it be required. This gives us a relatively inexpensive option to obtain additional material (Chart 12).

Our FY 1989 request (Chart 13) will provide the nuclear materials required in the near term and the capability to produce the material required to meet DOD plans in the long term. However, due to the fragility of our facilities, we are concerned about our ability to continue to produce nuclear materials in the near term. To address safety concerns, we have provided for a significant infusion of resources to respond to the National Academy of Sciences and other recommendations. Our request will provide improvements in the areas of emergency planning, aging, backfitting, training, incident analysis and trending, probabilistic risk assessment, severe accidents, maintenance, and plant modernization. Resolution of these concerns should increase the public's confidence in our ability to operate our facilities in a safe manner.

We need to move ahead to assure reliable and flexible supply alternatives for nuclear material. We have included funding for a New Production Reactor to provide an assured supply of tritium in the late 1998-1999 time period and beyond. In FY 1988, we plan to select the preferred technology and site through a series of reviews culminating in a evaluation by the Department's Energy System Acquisition Advisory Board. We would then begin the environmental impact statement (EIS). In FY 1989, we plan to continue the EIS which will result in final selection of both the technology and the site. We are continuing efforts to support deployment of the Special Isotope Separation technology, which will provide us with a reactor-independent supply of plutonium in 1995. We will be completing the environmental impact statement on SIS this year, and construction will begin in FY 1989. We have also included the required funding to continue to upgrade our complex both to meet mission requirements as well as regulatory and safety needs.

Defense Waste and Environmental Restoration

We continue to support the efforts to safely store and dispose of radioactive and hazardous wastes. Our funding request for FY 1989 (Chart 14) recognizes the transition from storage at various locations to disposal operations. To demonstrate disposal of transuranic waste, the Waste Isolation Pilot Plant near Carlsbad, New Mexico (Chart 15), comes on-line in FY 1989. Treatment of high-level waste for disposal in a geologic repository is the function of the Defense Waste Processing Facility (Chart 16) at the Savannah River Plant. This facility completes its year of preoperational checkout, with operation planned for late FY 1990. These actions constitute critical early elements of our Defense Waste Management Plan. We also are focusing on the next phase of the plan with our increased funding for a high-level waste immobilization facility for the Hanford Reservation. This facility will demonstrate the Administration's commitment to prepare high-level waste at Hanford for disposal.

Eventually, defense high-level waste is to be disposed of in the geologic repository being developed under the Nuclear Waste Policy Act. We are now developing a Memorandum of Understanding with the Office of Civilian Radioactive Waste Management which will address the arrangements for the disposal of defense high-level waste.

As you are aware, we consolidated management of all Defense Programs environmental remedial actions (Chart 17) for inactive hazardous and radioactive waste sites and facilities under the Defense Waste and Environmental Restoration Program in FY 1988. The objectives of this program are to identify, characterize and restore these sites and facilities in order to ensure compliance with applicable laws and regulations. We are regulated in this area by the Environmental Protection Agency and the States. Many remedial actions have been incorporated into strict compliance schedules through either the Resource Conservation and Recovery Act (RCRA) permitting process or through consent orders and compliance agreements with the Environmental Protection Agency and State regulators. Cleanup of the balance of the inactive sites must be performed under the requirements of the Comprehensive Environmental Response, Conservation, and Liability Act (CERCLA). We have increased this funding by about 24 percent in FY 1989 to address our responsibilities to clean up contamination from past activities.

Security Affairs

Our overall Security Affairs program plays an extremely critical role in fulfilling our national security mission. Activities include preventing theft or sabotage of nuclear weapons, materials, facilities, and the compromise of classified information; providing nuclear weapons expertise to the Intelligence Community; controlling the export of nuclear materials technology and equipment; providing technology necessary to monitor treaty compliance; and providing technical and analytical support for DOE's role in arms control negotiations, policy formulation, and implementation. These activities are grouped into Verification and Control Technology, Security Investigations, and Nuclear Safeguard and Security categories for budget purposes (Chart 18).

Our Verification and Control Technology program addresses specifically the areas of treaty verification, intelligence, arms control, and control of sensitive technology (Chart 19). We are involved in arms control policy in two important ways. First, we participate actively in policy deliberations. On nuclear test issues, our expertise is particularly needed, given the pivotal role DOE plays in the design, testing, and production of nuclear weapons. Second, and integrally related to the position we take, are our verification technology development and analytical support roles. Specifically, our role is to ensure that treaties negotiated are within the constraints imposed by current limits of verification technology. Similarly, we seek to develop new verification technologies to support various provisions proposed by negotiation parties and envisioned for future arms control efforts.

We are committed to support the Intermediate-Range Nuclear Forces (INF) Treaty and to provide the basis for verification agreements necessary to allow further arms reduction initiatives to be undertaken. Currently, the U.S. is negotiating with the Soviets to refine the verification measures of the Threshold Test Ban and Peaceful Nuclear Explosions Treaties signed in 1974 and 1976 and awaiting ratification. To this end, U.S. and Soviet scientists recently concluded reciprocal visits to the Semipalatinsk and

Nevada Test Sites. Joint verification experiments are planned for these sites in the near future.

With regard to Security Investigations, our request reflects our commitment to a multi-year initiative to reduce our backlog of overdue security reinvestigations. During FY 1987 and 1988, the Office of Personnel Management, which does most of our investigations, and the Department, have made significant efforts to reduce the backlog of reinvestigations. Through the hiring of additional investigators in FY 1988 and the availability of carryover funds, we expect to have about 20,000 reinvestigations conducted in both FY 1988 and 1989. We feel this effort is critical to assuring our personnel meet our high security standards.

OUR COMMITMENT TO SAFEGUARDS AND SECURITY

We have improved the Department's safeguards and security posture. The safeguards and security research and development program has played an important role in this accomplishment. Our request continues to ensure adequate protection of the DOE's nuclear weapons, nuclear materials, facilities, and classified information against terrorism, theft, and compromise (Chart 20). Our Defense Programs-wide budget for Safeguards and Security activities (Chart 21) indicates that funding has leveled off indicating we have defined and adequately funded our critical security improvements.

OUR COMMITMENT TO PRODUCTION ASSURANCE/ENVIRONMENT, SAFETY, AND HEALTH (PA/ES&H)

We are just beginning to address the ES&H needs of an aging complex. Significant resources will be required for the foreseeable future to modernize and replace these fragile production facilities. Inadequate funding for essential environmental, safety, and health requirements can result in enforcement actions by Federal/State regulators and a potential for curtailment of operations, thus impacting our ability to assure our production. Consistent with Secretary Herrington's plans to strengthen the Department's ES&H program, we are developing a comprehensive long-range plan for Defense Programs to better define the scope and cost of our existing and potential PA/ES&H problems; but we know it is going to be an expensive process. For example, we have estimated that our total PA/ES&H funding level (Chart 22) will be be about $1 billion in FY 1989 - that is up about 40 percent from FY 1988 and represents about 15 percent of our total FY 1989 request.

The Effluent Treatment Facility at Savannah River (Chart 23) is just one example of the kinds of improvements we are making at our sites. This project will cost $50 million, is mandated by the 1986 Amendment to RCRA and must be operational by November 1988. We are on schedule.

The challenges and problems we have faced are significant. We are stretched to the limits by operating a 30-40 year old complex which is receiving increasingly strong regulatory pressures. We feel we are doing a good job of meeting Department of Defense requirements with our increasingly fragile complex. We are also making positive efforts to assure safety of our operations. In response to the Chernobyl accident, Secretary Herrington engaged the National Academies of Science and Engineering (NAS/NAE) to review our Class A reactors. That report was provided in October 1987, and we are addressing the concerns specified in the report. Of particular relevance are the conclusions and recommendations described under the "Technological Vigilance" issue in the NAS/NAE Report. The Department's production reactor operating contractors are undertaking aggressive programs to enhance the technical competence and capability devoted to the reactors as well as the experimental and analytical base to support reactor safety. The Department is also evaluating the actions needed to strengthen its in-house technical capability to manage the safety of its production reactors in addition to strengthening its separate oversight function. We have an increase of $88 million in the FY 1989 budget to address the requirements of the NAS and other reviews, e.g., technical safety appraisals.

I can assure you that we will continue to put forth our very best efforts to meet ES&H requirements in order to assure our production objectives can be met. With your help, we will comply with ES&H laws and regulations while meeting national security objectives.

CLOSING REMARKS

I personally want to thank you for your support over the past year. It has been a significant factor in the successful execution of our mission responsibilities. With your continued support and leadership, we will continue to provide this Nation with a viable nuclear deterrent capability. I would be pleased to answer any questions you may have.

CHART 1

DEFENSE PROGRAMS MISSIONS

- o SUPPORT NATIONAL SECURITY POLICIES OF THE UNITED STATES FOR A NUCLEAR DETERRENT
- o PROVIDE SAFEGUARDS AND SECURITY FOR NUCLEAR WEAPONS, DEVICES, MATERIALS, FACILITIES, AND INFORMATION UNDER DOE CONTROL
- o PROVIDE SAFE, HEALTHFUL, AND ENVIRONMENTALLY ACCEPTABLE OPERATIONS OF DOE-OWNED FACILITIES UNDER DEFENSE PROGRAMS CONTROL

CHART 2

WEAPONS DEVELOPMENT, TESTING AND PRODUCTION AND NUCLEAR MATERIALS SITES

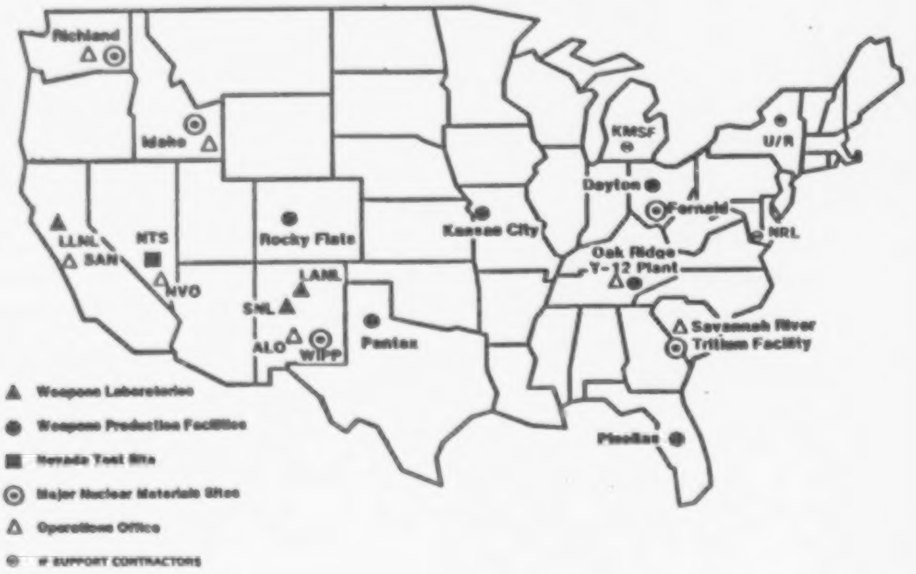

Richland
Idaho
KMSF
U/R
Dayton
Fernald
NRL
LLNL
SAN
NTS
NVO
Rocky Flats
Kansas City
Oak Ridge
Y-12 Plant
LANL
SNL
ALO
WIPP
Pantex
Savannah River
Tritium Facility
Pinellas
▲ Weapons Laboratories
● Weapons Production Facilities
■ Nevada Test Site
◎ Major Nuclear Materials Sites
△ Operations Office
⊖ # SUPPORT CONTRACTORS

CHART 3

FY 1989 CONGRESSIONAL REQUEST
($ IN MILLIONS)

	FY 1987	FY 1988	FY 1989 REQUEST
WEAPONS ACTIVITIES	$ 4,163	$ 4,207	$ 4,257
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DEFENSE WASTE AND ENVIRONMENTAL RESTORATION	702	895	936
SECURITY AFFAIRS	194	231	260
TOTAL DEFENSE PROGRAMS	$ 6,907	$ 7,142	$ 7,470
			+5%

CHART 4

SUMMARY OF FY 1989 INCREASES
($ IN MILLIONS)

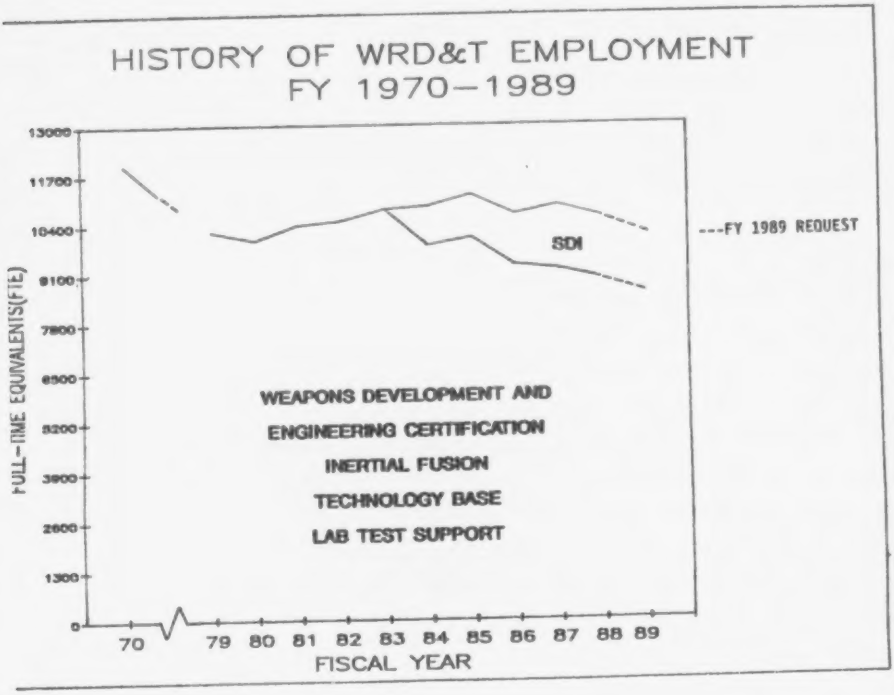
FY 1988 CONGRESSIONAL BUDGET		$7,142
o NEW PRODUCTION REACTOR	+ 40	
o NAS/OTHER RECOMMENDATIONS	+ 88	
o WIPP-RELATED ROAD CONSTRUCTION	+ 43	
o INCREASED ENVIRONMENTAL RESTORATION SUPPORT	+ 20	
o BUILDING 371 UPGRADE	+ 18	
o HANFORD WASTE VITRIFICATION PLANT	+ 15	
o JOINT VERIFICATION EXPERIMENTS	+ 10	
o REDUCED WEAPONS LABORATORY CORE FTE'S	- 26	
o OTHER REDUCTIONS (PRIMARILY PRIOR YEAR DEOBLS.)	- 67	
o ESCALATION (OPERATING, EQUIPMENT, GPP)	+ 187	
TOTAL INCREASE		+328
FY 1989 CONGRESSIONAL REQUEST		$7,470

CHART 5

WEAPONS RESEARCH, DEVELOPMENT AND TESTING (RD&T)
($ IN MILLIONS)

	FY 1987	FY 1988	FY 1989 REQUEST
CORE RD&T	$ 1,377	$1,467	$1,465
NUCLEAR DIRECTED ENERGY WEAPONS	317	279	285
INERTIAL FUSION	152	159	164
TOTAL	$ 1,846	$ 1,905	$ 1,914

CHART 6



HISTORY OF WRD&T EMPLOYMENT
FY 1970–1989

CHART 7

CHART 8

[Deleted]

CHART 9

WEAPONS IN PRODUCTION
FY 1989

B61 BOMBS

W80-0 SEA LAUNCHED CRUISE MISSILE WARHEAD

W80-1 AIR LAUNCHED CRUISE MISSILE WARHEAD

B83 BOMB

W87 PEACEKEEPER (MX) WARHEAD

W88 TRIDENT II WARHEAD

CHART 10

WEAPONS PRODUCTION AND SURVEILLANCE
FY 1989 CONGRESSIONAL BUDGET REQUEST
($ IN MILLIONS)

	FY 1987	FY 1988	FY 1989 REQUEST
DECISION COSTS	$ 508	$ 510	$ 531
PRODUCTION BASE	1,739	1,718	1,730
TOTAL	$2,247	$2,228	$2,261

CHART 11

CHART 12

[Deleted]

CHART 13

NUCLEAR MATERIALS PRODUCTION
FY 1989 CONGRESSIONAL BUDGET REQUEST
MAJOR ACTIVITIES
($ IN MILLIONS)

	FY 1987	FY 1988	FY 1989 REQUEST
BASE PROGRAM	$1,188.1	$1,080.7	$1,075.7
ENVIRONMENTAL, SAFETY AND HEALTH	272.2	301.8	434.6
SAFEGUARDS AND SECURITY	151.6	168.9	176.1
NEW PRODUCTION REACTOR	0	20.0	60.0
SPECIAL ISOTOPE SEPARATION	73.9	95.8	101.4
NAVAL REACTOR SUPPORT	162.4	141.5	169.0
TOTAL	$1,848.2	$1,808.7	$2,016.8

CHART 14

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION
FY 1989 CONGRESSIONAL BUDGET REQUEST
MAJOR ACTIVITIES
($ IN MILLIONS)

	FY 1987	FY 1988	FY 1989 REQUEST
BASE PROGRAM	$437.7	$487.3	$512.9
DEFENSE WASTE PROCESSING FACILITY	186.6	217.0	210.1
WASTE ISOLATION PILOT PLANT	23.4	85.7	113.1
HANFORD WASTE VITRIFICATION PLANT	0	7.5	22.5
ENVIRONMENTAL RESTORATION	53.8	97.8	120.9
SUBTOTAL	701.5	895.3	979.5
PRIOR YEAR DEOBLIGATION/ADJUSTMENTS	-	-	-43.0
TOTAL	$701.5	$895.3	$936.5

CHART 15

[Deleted]

CHART 16

[Deleted]

CHART 17

CHART 18

SECURITY AFFAIRS
($ IN MILLIONS)

	FY 1987	FY 1988	FY 1989 REQUEST
VERIFICATION & CONTROL TECHNOLOGY	$ 97	$ 121	$ 140
SECURITY INVESTIGATIONS	33	32	40
NUCLEAR SAFEGUARDS & SECURITY	64	78	80
TOTAL	$ 194	$ 231	$ 260

CHART 19

[Deleted]

CHART 20

[Deleted]

CHART 21

DEFENSE PROGRAMS
SAFEGUARDS AND SECURITY ACTIVITIES
FY 1989 CROSSCUT BUDGET ESTIMATE
($ IN MILLIONS)

	FY 1987	FY 1988	FY 1989 REQUEST
OPERATING EXPENSE	$ 516	$ 555	$ 581
CAPITAL EQUIPMENT	37	38	37
CONSTRUCTION	104	110	87
TOTAL	$ 657	$ 703	$ 705

CHART 22

PRODUCTION ASSURANCE/
ENVIRONMENTAL SAFETY AND HEALTH FUNDING
FY 1989 CROSSCUT BUDGET ESTIMATE
($ IN MILLIONS)

	FY 1987	FY 1988	FY 1989 REQUEST
OPERATING EXPENSE	$485	$568	$792
CAPITAL EQUIPMENT	33	38	55
CONSTRUCTION	133	135	173
TOTAL	$651	$741	$1020
ENVIRONMENTAL COMPLIANCE AND PROTECTION	$383	$472	$574
HEALTH AND SAFETY	268	269	446
TOTAL	$651	$741	$1020

CHART 23

[Deleted]

STATEMENT OF DR. ROBERT B. BARKER, ASSISTANT TO THE SECRETARY OF DEFENSE FOR ATOMIC ENERGY, DEPARTMENT OF DEFENSE

Senator JOHNSTON. Dr. Barker.

Dr. BARKER. Senator Johnston, Senator McClure, Senator Domenici, Senator Hatfield, I am basically here to say that the Department of Defense wholeheartedly endorses the Department of Energy Defense Programs budget and to add our voice in seeking your approval of the budget as presented.

I want to take this opportunity to amplify on some of the points Mr. Wade just reviewed.

NUCLER WEAPONS COUNCIL

I think, most significantly, the Nuclear Weapons Council, which was really in its first full year of operation in 1987, played a very major role in developing the Department of Defense and the Department of Energy Defense Programs budgets as they have been presented to you.

In January of this year in the aftermath of the budget summit, the Nuclear Weapons Council, in conjunction with OMB, really sat down and addressed the issue of the size of the Defense Programs budget that would be necessary to meet defense requirements after the defense alignment as a result of the budget summit. I think that the Nuclear Weapons Council in doing that work really performed the job that had been expected of it when it was established by Congress in 1986.

The Council is going to continue to look at the long-term relationship between DOD and DOE budgets. Certainly the study that Congress has asked us to do and report in December of this year will be a helpful mechanism through which to look at that. And what Defense is going to be doing is really sitting down and asking the question: What size stockpile can we afford? Also, we will try to level out the production load such that DOE can put together a sensibly sized complex that can meet that requirement.

We, of course, have thought we have done that exercise over the years, and so this is not something new. But, clearly, the budget summit resulted in significant cuts in the Defense programs, in general. Secretary Carlucci has said we see another $200 to $300 billion cut having to come out of the 5-year plan above what we had expected, and how it is going to affect Defense systems—nuclear weapons systems—and their ultimate impact on DOE is something we are going to be struggling with through the summer and into the fall.

The Nucler Weapons Council will play a critical role in looking at the diversion of effort between Defense and Energy to make sure they are synchronous.

NEW PRODUCTION CAPACITY

As part of this exercise, we also looked very hard at the nuclear materials situation. We wholeheartedly support the construction of a capability for new production of tritium as quickly as possible. Frankly, I go through life with my fingers crossed.

[Deleted.]

We have to keep our fingers crossed and hope that the Savannah River reactors continue to operate through 1998, which is when DOE tells us is the earliest we can expect to see a new production reactor in operation. So we are very strong supporters of a new production capability for tritium.

In the last year, the Nuclear Weapons Council initiated two phase 3 studies, one on the Small ICBM—that study is a little bit on the back burner right now since the administration has decided to let the next administration decide what the fate of that program will be. We also initiated a phase 3 program on the SRAM II warhead.

As you will remember, last year I pointed out the really critical need for this system. It has to be one of our highest priorities.

Over the years, we have initiated development programs that would ensure that only warheads with insensitive high explosive on them will be [deleted]. So it is very important to us that we keep the SRAM II program on track because that new missile will have an insensitive high explosive warhead.

Senator JOHNSTON. How far away will that be?

Dr. BARKER. It is going to take us until [deleted] to get SRAM II deployed if we proceed with the schedule we are currently on.

NUCLEAR WEAPONS STOCKPILE

In addition, the Council has continuously reviewed the safety, security, and use control aspects of the stockpile, and annually those things are reviewed by a committee subordinate to the Nuclear Weapons Council and by the Nuclear Weapons Council itself.

Last year, I made a commitment to you that I would review with you a short status report on the stockpile. I think that this committee and its counterparts who review the Defense Programs budget are part of the system that makes our deterrent as safe and as credible as it needs to be, and I thought you might want a thumbnail sketch of what has happened to that stockpile out there in the last 12 months.

As of the end of last year—as of December 31—the stockpile had [deleted] what it was a year ago. The total now is some [deleted] weapons, and that is down from a peak [deleted] in 1967. So we have gone from [deleted] in 1967 down to less than [deleted] today.

Today, there are 27 different types of warheads in the stockpile, and that, in a sense, is much more important than the number of weapons in the stockpile in terms of what we asked of the Department of Energy. Clearly, we expect to be able to modernize the production complex. We also need to turn over the stockpile as it becomes technically obsolescent. So the size of the stockpile determines what the average production capability of DOE needs to be. But the whole RD&T complex is driven by the number of different types of weapon systems that must be maintained. Today that number is 27, and it has been about that number for some significant length of time.

However, in the [deleted] we will be retiring [deleted] of those 27 types. As a result of the INF Treaty, assuming its ratification, we will be removing the Pershing II, the ground-launched cruise missile, and the Pershing I from the stockpile and we will not be replacing those systems with replacement systems.

[Deleted.]

In the foreseeable future those [deleted] systems are to be retired. The only potential new system that might come in would be the tactical air-to-surface missile. The other things that will be placed into the inventory will basically be total replacements for things that are already there.

So the [deleted] will have set in motion things that will lead to a net decrease of [deleted] of 27 types, which is not an insignificant fraction in the stockpile.

Today, the stockpile yield is a little under [deleted] megatons. That compares to 1960 when it was over [deleted] megatons. That is an impressive reduction. Of course, the reduction in yield has tracked and paralleled the increase in accuracy of delivery systems and we have asked the Department of Energy to produce ever smaller warheads, smaller yields, in response to increasing system capabilities.

The biggest bomb in the inventory is the [deleted].

Senator JOHNSTON. How many [deleted]?

Dr. BARKER. How many? [Deleted] bombs.

The smallest weapon in the inventory [deleted].

Senator JOHNSTON. [Deleted.]

Dr. BARKER. [Deleted.]

Senator JOHNSTON. Which weapon is that?

Dr. BARKER. It is the [deleted].

The oldest single weapon in the stockpile is the Nike Hercules warhead. [Deleted.] That warhead will be 30 years old in September of this year.

[Deleted.]

STOCKPILE MODERNIZATION

Despite the fact that we have been modernizing the stockpile with some degree of success, the average age of the stockpile has actually increased by a half a year. That is, the average weapon is one-half year older today than it was a year ago. The average age has gone up from 12.8 to over 13 years on average.

Let me show you another snapshot of what has been going on.

[Chart deleted.]

Dr. BARKER. Working together with the Senate and with the Congress, we have modernized essentially one-third of the stockpile in the last 7 years, so that that stockpile now has modern safety and security features. That is the pie diagram on the left. I will amplify a little bit of what I mean by "modern." Modern means modern safety and security features in the weapons, modern weapons control features.

If we keep in motion every program we have started together, by [deleted] percent of the stockpile will meet this definition of modern. However, [deleted] percent will still be old technology.

Senator JOHNSTON. Now, that is PAL?

Dr. BARKER. Right. I am going to go through it in just a moment what I mean by those features when I say that.

The point is, of course, when I say modern, [deleted] percent will be modernized by [deleted]. Some of those systems will already have been in the inventory [deleted] years at that point in time. But at least they will be up to the current modern standard of safety, security, and use control. Let me go to the next series of charts.

[Chart deleted.]

Dr. BARKER. Clearly, our modernization program is really driven by the obsolescence of nuclear systems, so we tend to modernize those systems which no longer perform their military mission because they are militarily deficient in the job they are supposed to do. But as we do this modernization for reasons of improving military effectiveness, we do include modern safety and security features. Where we see particular problems we will actually go back and do a retrofit where we can. We can improve the degree of safety in a retrofit fashion for already stockpiled weapons, but we cannot do everything.

In the use control area, modern technology is really the thing and it is up there called category D and category F, permissive action links, or PAL's.

You will see that currently [deleted] percent of the stockpile has some kind of a use control feature on it, and of that, [deleted] percent are what we call modern safety features.

Now we have not put these kinds of things [deleted]. We put these features onto warheads which are deployed in places where it is conceivable that they might be subject to terrorist attack or unauthorized use. That is where these features are included within the weapon itself.

By [deleted] we are going to be up to [deleted] percent of the stockpile that will have these use control features; [deleted] percent will be what we call modern.

If you will go to the next chart.

[Chart deleted.]

Dr. BARKER. You have heard an awful lot about the insensitive high explosive, and I will not repeat its advantages. Despite all you have heard about the advantages of insensitive high explosive today, only [deleted] percent of the stockpile has it in it.

By [deleted] percent of the stockpile will have insensitive high explosive in it.

There are [deleted] systems in the inventory in which it is technically impossible to perform the military function and use insensitive high explosive. That is in the [deleted]. We do not know how to make [deleted] that uses insensitive high explosive. But, in theory, it could be in every other system in the inventory. Even by [deleted] we are only going to be at the [deleted] percent point. But it will be on most systems. [Deleted] I guess all will have insensitive high explosive at that time. So tactical systems that you might expect to move substantially will have insensitive high explosive.

Senator DECONCINI. Would you repeat that, please?

Dr. BARKER. I should check this, but I believe it was the [deleted] will have insensitive high explosive.

Senator DECONCINI. Does that imply we will not have [deleted]?

Dr. BARKER. I am sorry, except for [deleted].

Senator DECONCINI. All right.

Dr. BARKER. Yes; thank you for bringing that up. Every one that it can conceivably go into will have it.

Senator MCCLURE. Mr. Chairman, may I ask a question?

Senator JOHNSTON. Yes.

Senator MCCLURE. Doctor, with the budget pressures, is there sufficient pressure to continue the modernization and safety part of this program or does that get a little less impetus when you are under tight budgets?

Dr. BARKER. I would have to say that history says whenever budgets get tight, the systems that tend least to slip are the strategic weapon systems for which most of these features I have talked about do not play a significant role. They are the ones that tend to get the highest priority. So if you look over what has happened, when our plans change from one year to the next because of fiscal constraints, it tends to be the tactical systems that stretch out.

I would not like to see that happen while I am on the job, but the pressures get awfully tense at times.

So it is something I think the committee should be concerned about, and should ask about every year in terms of what has happened with the plans to make the charts I have just shown you a reality because that is the best we can do under current planning.

Senator HATFIELD. Mr. Chairman, could I interrupt a moment and ask a question?

Senator JOHNSTON. Yes.

Senator HATFIELD. This hearing is classified, correct?

Senator JOHNSTON. Correct.

Senator HATFIELD. I hope that includes questions and answers.

Senator JOHNSTON. I think so.

Senator HATFIELD. And even though the discussion on the Q and A may involve unclassified material, it is still a classified surrounding?

Senator JOHNSTON. I think the hearing is. If you have a Q and A that you want unclassified, I think you could probably work out an arrangement. But that is unclassified.

Senator HATFIELD. I just wanted to clarify that, because I have a number of questions that involve the N Reactor and it has a lot of public concern and interest that I think perhaps I should wait and put those questions in an unclassified environment. I don't handle classified material. I refuse to accept it because I do not want to be a target of leaks and all that. But I do have some questions that I, perhaps, Mr. Chairman, would think we could work out on a one on one, or I might request the Chair to call these gentlemen back at sometime down the road for an unclassified meeting.

Senator JOHNSTON. Well, if you would like to do it by letter. Would you prefer to do it by letter or would you rather have an open hearing?

Senator HATFIELD. It makes no difference. I am just interested in the information; I am not so interested in the format.

Senator JOHNSTON. Well, why don't you submit a letter, and if you would like me to join in it, I will, and if both of you gentlemen would be glad to answer it.

Dr. BARKER. Sure; we would be pleased to do that.

Senator JOHNSTON. Thank you.

NONVIOLENT DISABLEMENT

Dr. BARKER. Nonviolent disablement is another very important feature for weapons that could go in harm's way. Today, if a U.S. commander were threatened with the possibility of hostile takeover of his nuclear weapons, the only mechanism he has to deny those weapons to a potential enemy is [deleted].

The Department of Energy has developed a destruction technique [deleted] such that anyone who gains possession of it would not have a lethal weapon of his own. [Deleted.]

You can see the numbers up there. The fraction today is a little under [deleted] percent. But [deleted] it will be about [deleted] percent.

[Chart deleted.]

Dr. BARKER. The last feature we talk about for modern weapons is a safe, predictable accident response. This has to do with the safety in an accident environment as a result of the fact that you are apt to have spurious electrical signals. Any time you have a power source to wires in an accident, you may end up with voltage where you do not want it.

Again, the Department of Energy, with their very serious commitment to the safety of nuclear weapons, has designed procedures which literally can preclude the most dangerous kinds of situations in an accident situation. We are up above [deleted] percent now with the stockpile, and by [deleted] we will be up in the [deleted] percent category.

This is one of the features that can be added on to an existing weapon, and this is what we have done in a number of cases.

[Deleted] predictable accident safe response can be added on to older designs.

I have just three issues—maybe four issues—I would like to conclude with.

MODERNIZATION

I have already mentioned the importance that we place on SRAM II [deleted].

With respect to the European theater, there are two systems where we are currently operating under congressional restraints that are inconsistent, incompatible with what SACEUR and what worldwide commanders-in-chief believe are our requirements.

We are currently operating under a constraint of a 925 limit on production of modern artillery shells. That 925 limit does not allow us to meet the requirements as laid down by SACEUR or other commanders worldwide. We would like to get that 925 limit lifted so that we can meet the identified requirements worldwide for modernization.

We find ourselves in a dilemma, in a situation where we are holding onto some of the oldest weapons in the stockpile, the W–33, the old 8-inch shell, the W–48, the old 155 shell. In order to meet these requirements, as stated by military authorities, we would much rather they have modern W–79 and modern W–82 shells that provide them with all the safety and security, as well as the military effectiveness that the commanders in the field are asking for.

The other place where we need help is with respect to the followon to Lance missiles.

I want to thank this committee and the Senate and the Congress, as a whole, for removing the restriction that previously prevented us from even studying the possibility of a nuclear option for the Army tactical missile system, or the ATACMS. As a result, we have been studying ATACMS, along with other potential missile options, as a potential replacement for the followon to Lance missiles.

The Army expects to make a decision—a missile decision—[deleted]. Right now, there is still a constraint on ATACMS in that money cannot be spent on the development of ATACMS for nuclear application. If the Army should decide [deleted] that ATACMS is the most cost-effective, most sensible approach to a replacement for Lance, and the restraint is not lifted, we are informed that the initial operational capability for the followon to Lance will slip month by month until we can get that development restriction lifted.

So the Defense Department will be proposing specific language to remove the constraint on development of a nuclear option for ATACMS. The primary reason is in order not to delay the timeframe in which we could replace the old Lance system with a modern replacement, one called for by SACEUR, one endorsed by ministers in the last several years as a part of the Montebello nuclear weapons reductions that were made unilaterally by SHAPE and by NATO. Part of the basis for military authorities to accept those reductions in numbers was the assumption of modernization and the assumption that Lance would be modernized in [deleted].

In order for us to achieve delivery on that time scale, if ATACMS is chosen, we need to have that restriction on development relieved.

WEAPONS TESTING PROGRAM

I want to move on to a somewhat different subject now and that is testing.

The Defense Department strongly believes that testing is critical to our belief that we have a credible stockpile. My testimony goes into length with argument that you have heard from me in the past and I am not going to go into that. What I am going to do is express some concern.

As Secretary Carlucci has said, whenever you reduce a Defense budget such as we have done to the 1989 budget—take $33 billion out of it—you don't do that without some risk.

The Nuclear Weapons Council tried very, very hard to balance the risk between Department of Energy Defense Programs and DOD with respect to the 050 account in this year's fiscal year 1989 budget. One of the things that you saw happen means that we are now testing at a rate probably lower than any testing rate we have had since 19—was it 1958?

Mr. **Wade**. Fifty-four.

Dr. **Barker**. Fifty-four. Personally, I am concerned. I was a nuclear weapons designer once, and I really believe that testing, in addition to producing specific pieces of hardware, is what maintains the competence of the people we depend upon to just tell us what we have is all right. If you show a nuclear weapon designer a stockpile weapon with some changes that have occurred, and ask him, will this thing still work, you are asking for experienced judgment. A big part of that experience is based on the fact that these individuals have had to test their judgment out in real nuclear experiments.

As I said, I think we have done the best job we could under the circumstances, but I encourage the committee to ask that question of themselves as well, as to whether the kind of budget stringencies that we have been faced with have not pushed nuclear testing to an unacceptably low level in terms of maintaining a credible deterrent for the foreseeable future.

SUMMARY STATEMENT

Just to summarize, the Nuclear Weapons Council worked hard this year. I think it has worked well. I think we have met our weapons production goals. We have a long way to go as far as bringing safety and security up to modern standards in the stockpile. It is going to take sustained effort on the part of future administrations and the Congress to make those improvements, those modernizations a reality.

We do need some specific help in keeping SRAM II on track, removing the 925 limit on modern artillery shells, and allowing us to proceed with the development of the nuclear ATACMS should the Army conclude that that is the best course of action to take.

With respect to those latter two, I would remind you that the Senate, with respect to the fiscal year 1989 budget, will get every opportunity to appropriate moneys to build new artillery shells, and so there is an opportunity there to disapprove or approve whatever number the Senate sees fit to go along with.

There is a political reason for removing those constraints now.

I was in Europe last week participating in a meeting of the high-level group—the NATO Nuclear Planning Group meeting—involving all Defense Ministers at the end of April, and I believe that NATO will endorse modernization of our deterrent in Europe. I think the Congress, joining the administration, is the signal of lifting this cap on the 925 and committing the development of ATACMS as a nuclear Lance would be very significant messages to send in this particular timeframe.

With that, let me conclude my comments. Thank you.

[The statement follows:]

STATEMENT OF ROBERT B. BARKER, ASSISTANT TO THE SECRETARY OF DEFENSE (ATOMIC ENERGY) ON NUCLEAR WEAPONS PROGRAMS

INTRODUCTION

(U) Mr. Chairman, members of the committee, I am pleased to have this opportunity to present the views of the Department of Defense in support of the Department of Energy's proposed Fiscal Year 1989 nuclear weapons program. This is my second appearance before you as the Assistant to the Secretary of Defense for Atomic Energy and Staff Director of the Nuclear Weapons Council.

POLICY OF DETERRENCE

(U) I would like to begin my testimony with some selected quotes from Secretary Carlucci's FY 1989 Annual Report to Congress:

(U) "Since the dawn of the nuclear era, the focus of American strategic thought has been on deterring nuclear war by dissuading our adversaries from using nuclear weapons against the United States or our allies through the threat of retaliation. Similarly, we have relied on U.S. nuclear weapons to help deter conventional attack as well."

. . .

(U) "Despite the prospects for an effective strategic defense system, and the possibility of deep reductions in offensive strategic nuclear forces, the need to keep our nuclear deterrent and our conventional forces strong and ready remains as clear today as it has for well over a generation. Our recent experience in negotiating an Intermediate-Range Nuclear Forces (INF) agreement demonstrates that a strong commitment to maintaining and modernizing effective nuclear and conventional forces provides an essential incentive for the Soviets to negotiate seriously toward true arms reduction agreements."

. . .

(U) "Just as our commitment to implement the 1979 NATO Dual-Track decision was crucial in achieving an INF arms control agreement, so too is our commitment to the continued modernization of our strategic nuclear forces vital to any chances for success at the Strategic Arms Reductions Talks (START). Implementing the President's Strategic Modernization Program will improve the effectiveness, flexibility, and survivability of our strategic nuclear forces. This program has been accompanied by our START proposals to bring about significant reductions in both sides' nuclear arsenals."

. . .

(U) "More importantly, modernizing our strategic forces enhances our strategy of deterrence. Indeed, should we reach an agreement on deep reduction in strategic forces, we will possess a sound deterrent only if those forces we retain under an agreement are thoroughly modernized."

(U) I have repeated these segments of Secretary Carlucci's written report to you because of their special importance to the subject of these hearings, the Department of Energy's defense programs. The Secretary's message is clear -- modernized, effective, survivable nuclear weapons are essential to the deterrence of nuclear and conventional war. The budget request is central to this requirement.

NUCLEAR PROGRAM MISSION AND REQUIREMENTS

(U) As I stated last year, I believe it is useful to examine the mission and broad requirements placed on this country's nuclear weapons program in support of our national security. In the area of research, development, and testing (RD&T), the Safeguards which the Senate wisely incorporated as part of giving its consent to the ratification of the Limited Test Ban Treaty in 1963 (as modified in 1976) state the requirements:

- (U) The conduct, within the constraints of existing treaties on nuclear testing, of comprehensive, aggressive, and continuing underground nuclear test programs designed to add to our knowledge and improve our weapons in all areas of significance to our military posture for the future.

- (U) The maintenance of modern nuclear laboratory facilities and programs in theoretical and exploratory nuclear technology which will attract, retain, and ensure the continued application of our human scientific resources to those programs on which continued progress in nuclear technology depends.

(U) A vibrant ongoing nuclear weapons program is necessary and should be founded on the following:

- (U) For the production complex, the major factor in planning is the preservation of a capability to manufacture nuclear weapons and to maintain the stockpile. This requires the maintenance of specialized plants, facilities, and a pool of experienced personnel capable of handling a balanced demand for weapon manufacture,

- (U) For the special nuclear material component, the principal factors affecting resource planning are (1) the need to replace tritium periodically in order to keep the stockpile operable, and (2) the very long lead times and relatively high costs associated with obtaining additional plutonium, tritium, and highly enriched uranium.

- (U) For the R&D component, the most vital asset is the pool of trained and experienced scientists and engineers and the specialized facilities they use. There is no industrial or academic counterpart elsewhere in the U.S. for these capabilities. People experienced in nuclear weapon design and system nuclear survivability cannot be replaced easily or quickly.

- (U) Nuclear testing is essential to providing for safe and secure warheads and weapons systems. It also is essential if we are to maintain weapon reliability and effectiveness so that they are capable of performing their military missions. Nuclear testing is also required to ensure that the weapon systems, themselves, are survivable. Nuclear testing has permitted us to respond to Soviet measures, which if left unanswered, would have undermined the credibility of our deterrent.

(U) As you are well aware, in addition to research on traditional nuclear weapon technologies, the Department of Energy has been pursuing Nuclear-Directed Energy Weapon (NDEW) research for several years, primarily in support of the Strategic Defense Initiative (SDI). Although the potential use of such weapons by the Soviet Union against a future U.S. defensive system is a major concern, Soviet developments in this area which could undermine the effectiveness of our current retaliatory deterrent are an equally grave prospect. For this reason, the Department of Defense would support the need for NDEW research even in the absence of a U.S. SDI program.

NUCLEAR WEAPONS COUNCIL

(U) Work by DOE's defense programs in support of the Department of Defense is under the oversight of the Nuclear Weapons Council (NWC). The Congress established the Council in the FY 1987 Authorization Act to provide broad oversight and guidance for nuclear weapons matters. The NWC has taken its responsibilities seriously; the recommendations of the 1985 Blue Ribbon Task Group (BRTG) on Nuclear Weapons Program Management have served as the blueprint for Council priorities. The preparation of the FY 1989 budget serves as an example. The NWC, in close coordination with the senior staffs of the Secretaries of Defense and Energy and in consultation with the OMB, developed a recommendation for the two Secretaries that would align the two budgets to maintain a balance between DoD requirements and the overall defense activities of DOE. Several program options were developed, costed out, and reviewed to find the balance between funding and requirements. The result was a decision to align the DoD and Atomic Energy Defense Activities budgets as they are presented in the President's budget. Within DoD, this required conscientious addressal of the need for nuclear weapons in relation to other DoD needs.

(U) The Council is also continuing to review the long-term relationship between DoD and DOE budgets. Part of that review will be participation in the study, mandated by the FY 1988/89 Authorization Act, to determine the overall size and productive capacity for a modernized nuclear weapons complex. To better understand these relationships, the Council members and the members of the standing committee which supports the Council have visited DoD nuclear operations bases and DOE materials and weapons production facilities during the last year. Using the insights from the visits and from the discussions they shared, the members support efforts to plan weapons fabrication and retirements, materials production, and new design efforts to eliminate fluctuation and to provide predictable requirements that best utilize a properly sized nuclear weapons complex.

(U) In preparing this year's nuclear weapons stockpile, the NWC not only reviewed the requirements but reviewed the special nuclear materials projections very carefully. The review determined that long-term production capacity is needed. Under any circumstances, capacity is needed for a continuous supply of tritium to ensure our existing nuclear weapons will work. The fragility of the current facilities for producing reactor products cannot and must not be ignored any longer. The NWC supports the DOE initiative to procure a new production reactor to ensure a continued supply of tritium.

(U) During this year, the Council has carefully reviewed the requests for and endorsed the initiation of engineering development for new warheads for SRAM II and Small ICBM. (Subsequently, as you know, this latter program has been put on hold.)

(U) The NWC is also a key player in nuclear weapon system safety. The safe operation of the nuclear deterrence arsenal depends on careful design and fabrication of the nuclear systems and well thought-out operating procedures. As new systems are introduced, the responsible commanders' operational plans and the final nuclear weapon design are reviewed to decide what restrictions, if any, will be necessary for safe operation. After a system is fielded, the operations and procedures are periodically reviewed. In addition, they are reviewed whenever modifications are made to the system. The result of this process is a package containing the permitted system operations and a description of the system design. Each of these packages is reviewed by the Council before the Secretary of Defense's approval is sought.

(U) The Council also reviews annually the nuclear weapon safety, security, and use control programs of the two Departments. This review includes independent Department views on any outstanding issues. We think this independent, dual responsibility review provides a strong conscientious program.

STOCKPILE STATUS

(U) As a part of my testimony last year, I committed to annually update you on the state of the stockpile.

On December 31, 1987, the U.S. nuclear warhead inventory consisted of Deleted warheads, Deleted warheads from that of a year ago. At its peak, in 1967, the stockpile contained approximately Deleted warheads.

There are 27 different warhead types in today's inventory. However, we have set in motion processes which will remove Deleted warhead types from the active inventory in the near future; Deleted because of the INF Treaty, the W50 PERSHING I, the W84 GLCM, and the W85 PERSHING II will be removed from active inventory.

The yield of the total stockpile is Deleted MT. In 1960, the total yield was Deleted MT. The largest warhead in the inventory, of which there are Deleted

Deleted The smallest yield weapon in the inventory, of which we have Deleted

The oldest warhead type is the W31Y1, NIKE HERCULES, of which Deleted exist with an average age of 28.97 years. These weapons will be totally retired by Deleted The oldest individual weapon in the stockpile is a B28 bomb, produced in September 1958, making it now on the verge of being 30 years old. The average warhead age on December 31, 1987, was 13.15 years; one year earlier the average age was 12.79 years. We are still losing ground. Despite the efforts of the Administration and the Congress, the stockpile is aging faster than we can modernize it.

STOCKPILE MODERNIZATION

Nuclear weapon modernization has occurred primarily when an existing weapon system became viewed as no longer posing a credible deterrent in the face of Soviet measures which have adversely affected weapon effectiveness. Such Soviet measures include steps which threaten delivery system survivability and penetrability of defenses and/or steps which reduce weapon effectiveness, such as hardening or mobility of intended targets. The replacement weapon system generally requires a new warhead to be compatible with the environments which the new weapon system will impose on the warhead. The new weapon may have a smaller or larger yield than the weapon it replaces, depending, for example, on whether higher accuracies justify a lower yield or whether increases in target hardness require higher yields even with increased accuracy.

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Whenever a new weapon is designed, it incorporates state-of-the-art in nuclear weapon safety and security features.

During this Administration, approximately one-third of the stockpile will have been modernized with modern nuclear weapon safety and security features: Insensitive High Explosive (IHE), nonviolent disablement, safe predictable accident response, and modern use control features. As a result of the efforts of this Administration, with the support of the Congress, when the warhead production is completed, Deleted percent of the stockpile will have been modernized.

Insensitive High Explosive (IHE) is the most important safety feature of our modernization effort to reduce the risk of scattering plutonium. IHE provides protection against plutonium scattering in case of an accident that would set off the usual kind of high explosives. This IHE explosive will not detonate in violent accidents like aircraft crashes. Unfortunately, only Deleted percent of the stockpile currently has IHE. We are working to incorporate IHE in all appropriate warheads in the stockpile, but we have much to achieve. Currently, because of the penalty in weight and size associated with using IHE (it is less energetic than other high explosives), we are unable to make all warheads with IHE. We are currently unable to make Deleted Insensitive High Explosive. Even so, by Deleted percent of the stockpile will have IHE.

All nuclear weapons are protected by physical security and launch protection features. For some systems, use control devices within the warhead prevent use of that nuclear warhead by anyone who would breach our military security system and gain access to a weapon. There are several categories of warhead use control devices, ranging from combination locks on older weapons to the newest Category D and F Permissive Action Link (PAL) capabilities, integral to our newest theater nuclear weapons. Anyone trying to bypass use control systems Deleted Deleted will cause nonviolent disablement of the nuclear warhead parts in such a way it would render the nuclear weapon useless without major rebuild. Currently Deleted percent of the stockpile has use control devices. Deleted percent has Category D and F systems.) By Deleted percent of the stockpile will have warhead use control devices with Deleted percent being Category D and F.

Command disable allows a commander of a nuclear weapon storage site to disable a nuclear warhead

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Command disable cripples a nuclear warhead in such a way that it is impossible to derive a nuclear yield and Deleted doing so. Currently, Deleted percent of the stockpile has this feature. By Deleted percent of the stockpile will be so equipped.

Modern technology has brought us the ability to design electronics in a way that allows us to significantly reduce the probability that any accidental circumstance, including inadvertent electrical signals generated in crashes, fires, lightning strikes, etc., might cause the detonation of a nuclear weapon. We have been building new weapons with this capability since 1979. While we can and are modifying nuclear weapons to put in enhanced electrical features, we cannot do the entire stockpile at once. Currently Deleted percent of the stockpile has this enhanced electrical safety feature. By Deleted percent of the stockpile will have enhanced electrical safety features.

(U) Stockpile warheads planned for retention are reviewed annually by the Department of Defense (DoD) and the Department of Energy (DOE) to ensure their continued safety, security, and reliability. The nuclear weapon modernization process is not such that the oldest weapon is the next to be modernized; our objective is that priority in modernization goes to the system whose effectiveness as a deterrent is viewed as being most in need. As a result, some weapons have become so old that their safety and security features, while adequate to meet nuclear safety standards with added procedural safeguards, do not meet modern nuclear safety design criteria. This has led to Stockpile Improvement Program upgrades of particular weapon features of some weapons to redress these deficiencies.

STOCKPILE IMPROVEMENT PROGRAM

(U) The joint DoD/DOE Stockpile Improvement Program (SIP) was initiated formally by the Military Liaison Committee in 1979, with the goal of identifying the nuclear weapons in the stockpile that needed to be modernized, retired, or replaced. Each year a review examines each deployed weapon, its operating environment, Service recommendations, results of studies, present SIP efforts, and/or planned retirement/replacement programs.

The 1987 review found that the W69 warhead for SRAM A and the B53 strategic bomb require replacement. Both have operational commitments which, coupled with their development and production prior to the introduction of modern nuclear safety criteria, place them at the top of the list of weapons requiring replacement or modification for safety reasons. The SRAM A will be replaced by the SRAM II. The SRAM II warhead design incorporates modern safety and security features. With the reintroduction of the B53 into the stockpile, a SIP is being implemented this year *Deleted*

(U) Having reviewed activities relating to our stockpile improvement program, it is appropriate to turn now to a discussion of our modernization program which addresses those cases where requirements are best met by the development of new warheads and systems. However, before addressing the specific systems, a brief review of the role of Nonstrategic Nuclear Forces (NSNF), in particular the Short-range Nuclear Forces (SNF) seems timely. Following the NSNF discussion, I will review Naval and Air Force systems.

NATO MODERNIZATION

(U) Nonstrategic Nuclear Forces are integral to achieving the objectives of U.S. national security policy. They are a primary means by which the U.S. extends its nuclear deterrent to regions where U.S. allies face significant nuclear and nonnuclear threats. Extended deterrence, through the deployment of NSNF, provides reassurance to allies and friendly nations, and constitutes a tangible U.S. commitment to maintain a regional defense role and protect vital national and allied interests. NSNF deployments can complicate Soviet planning to the degree that Soviet goals would be unattainable. In this way, NSNF contribute to the deterrence of conventional aggression and the effectiveness of conventional defense should deterrence fail.

(U) Further, NSNF pose the threat of escalation to nuclear conflict as a result of regional nonnuclear aggression, including the possibility of attacks on the Soviet homeland. NSNF link the theater with both nonnuclear and central strategic forces, providing for a continuum of capabilities which is the *sine qua non* of a strategy emphasizing a response to aggression which is unpredictable from the aggressor's viewpoint, yet controlled from the defender's.

(U) NSNF must be capable of holding at risk and, if necessary, being employed in a selective use against, a wide range of targets integral to a Warsaw Pact offensive. Accordingly, NATO's NSNF must be properly balanced among short-range nuclear forces (Artillery Fired Atomic Projectiles (AFAPS) and LANCE missiles) and, in a post-INF era, dual-capable aircraft (DCA).

Although the following discussion centers on Short-Range Nuclear Forces (SNF), DCA have a significant role in NATO's nuclear planning. They are the most widely deployed NSNF system in NATO, and their flexibility provides the capability to hold at risk and attack key military targets in the non-Soviet Warsaw Pact and Soviet Union,

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SNF CONTRIBUTION TO DETERRENCE

(U) NATO'S SNF contribute to deterrence by providing a responsive capability to counter directly the leading elements of the Warsaw Pact ground forces, thus reducing the Pact's confidence in its ability to break through NATO's forward defenses. Forward and widespread deployment of sufficient numbers of SNF contributes to the Warsaw Pact's uncertainty as to when, where, and to what degree NATO will employ nuclear weapons. It also causes Pact commanders to limit massing and therefore disperse, thus greatly reducing their confidence of success. Widespread dispersal of SNF also reduces the Warsaw Pact's confidence in its ability to preempt or otherwise neutralize NATO's nuclear retaliatory capability in Europe.

SNF are deployed with the forces of Deleted NATO countries Deleted demonstrating the shared commitment of alliance members to NATO's strategy of flexible response and to the concept of forward defense. This shared commitment is crucial to deterrence, because deterrence is dependent on the Warsaw Pact's perception of NATO's will.

SNF IN THE WAKE OF THE INF TREATY

NATO's strategy of flexible response and forward defense remains valid in the wake of the INF Treaty. NATO must continue to possess a mix of nuclear capabilities that provide deterrence through a spectrum of potential military responses to Soviet aggression. SNF will have an important role in this regard

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Requirements identified prior to the INF Treaty to modernize and increase the survivability of NATO's SNF remain essential in order to ensure that NATO's remaining SNF provide effective capabilities that are credible to Soviet political leaders and military commanders. Such steps are a necessary complement to the substantial reductions that have already taken place in NATO's European nuclear stockpile, Deleted

Deleted As yet, there is no evidence of comparable restraint by the Warsaw Pact.

NATO NONSTRATEGIC NUCLEAR FORCE (NSNF) MODERNIZATION

(U) Turning now to NSNF modernization requirements, they primarily stem from NATO's 1983 Montebello decision and are detailed in SACEUR's Nuclear Weapons Requirements Study (NWRS) 85. They derive from the routine process of updating military equipment in the face of component aging and development in the threat. They are not, therefore, linked to the INF Treaty or a consequence to that Treaty. Their importance, however, will increase as a result of INF missile elimination.

(U) The main elements of this nonstrategic nuclear force modernization program which encompasses both short-range nuclear forces and dual capable aircraft with their associated weapons are as follows:

- The development of a standoff Tactical Air to Surface Missile (TASM);
- The continued modernization of NATO's dual-capable (nuclear-conventional) aircraft and associated nuclear bombs;
- The development of a Follow-on to LANCE (FOTL) surface-to-surface missile with increased range, improved accuracy, and improved operating characteristics; and
- The continued modernization of NATO's Artillery-Fired Atomic Projectiles (AFAPS).

In addition to these measures, NATO ministers have also supported the need to *Deleted* *Deleted* - improve the survivability of NATO's nuclear forces; and improve their command and control.

Tactical Air-to-Surface Missile (TASM). SACEUR's NWRS-85 called for a TASM

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Although TASM warhead requirements are not yet fully defined, we intend to study a range of options for satisfying the TASM requirements.

(U) The nuclear bomb modernization program involves replacement of older bombs with modernized bombs. It is directed toward improving the overall safety, security, survivability, and effectiveness of the tactical nuclear bomb stockpile. We are currently producing B61-3 and -4 tactical nuclear bombs, both of which incorporate modern safety and security features. We will also have a stockpile improvement to existing older B61 tactical bombs.

Follow-on to LANCE. NWRS-85 specified a requirement for Deleted Deleted The study envisioned FOTL application against mobile follow-on forces at mid ranges, thus fulfilling essentially the same role as LANCE but with increased flexibility. The elimination of INF missiles, however, impacts upon the role and importance of FOTL. As the only ballistic theater system remaining committed to NATO, it will serve to complicate Warsaw Pact defense planning processes which would otherwise be able to concentrate on DCA.

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The current LANCE missile system, fielded in 1972, is manpower intensive, Deleted A Service Life Extension Program (SLEP) was initiated in FY 1986 to restore the capability and extend the life of the system Deleted Deleted Our NATO allies are participating in the SLEP. The SLEP is a minimum fix of shelf-life expired components of the guidance section and warhead adaptation kit. Funding of

$15.3M to complete the SLEP was authorized but not appropriated in the FY 1988 DoD budget. The Army must complete safety and reliability elements of the SLEP Deleted Deleted

(U) A Follow-On to LANCE (FOTL) with increased range and survivability, modern nuclear safety technology, and force structure savings will support joint Army-Air Force doctrine and be fully integrated in the deep battle concept. The improved capabilities of FOTL will support deterrence by holding at risk the lead elements of offensive forces. It will significantly improve the short range nuclear option required by US/NATO strategy.

Deleted We are very appreciative that Congress, in the FY 1988-89 DoD Authorization Act, authorized study of the ATACMS as a candidate for the FOTL. However, remaining Congressional restrictions prevent development of the ATACMS for this mission. If ATACMS is deemed the most promising candidate, these restrictions would preclude meeting SACEUR's requirement Deleted The DoD and DOE have initiated a joint Phase 2 Warhead Feasibility Study to define the nuclear warhead for the Follow-On to Lance. Upon completion of this study and upon development of warhead decision cost information, a decision will be made as to whether or not we are ready to move into engineering development of a nuclear warhead for FOTL.

As with the FOTL, modernization of AFAPS is a long standing requirement. Modern AFAPS, the W79 (8") and W82 (155mm), offer major improvements Deleted Deleted modern safety features, command and control, survivability and Deleted over their 1956 and 1963 vintage predecessors which are among the oldest operational nuclear munitions in the national inventory. Production of the W79 was completed in 1986. The W82 is in engineering development with a planned IOC in the *Deleted* The FY 1985 DoD Authorization Act limited modern AFAPS to a total of 925 (W79 and W82 combined), and a $1.1B DOE production spending cap.

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Congressional authority to produce additional W82 (155mm) warheads would permit retirement of the older AFAPS that are being retained to meet the CINCs' needs.

(U) Retaining the older AFAPS and current LANCE in the inventory does not satisfy the requirements expressed by SACEUR, other CINC's and our allies and does not alleviate the shortcomings mentioned above. In effect, due to the inevitable erosion over time of their reliability and effectiveness (even with the replacement of parts) with respect to the more recently fielded comparable Soviet systems, the indefinite retention of these older systems is equivalent to a unilateral reduction of our short range nuclear force warfighting effectiveness and its contribution to deterrence.

NAVY THEATER NUCLEAR WEAPONS

The United States cannot afford to invite a nuclear war-at-sea. Theater Nuclear Weapons (TNW) are an integral part of the Navy's overall war-at-sea strategy. Navy TNW deter Soviets from initiating tactical nuclear war at sea and would be used, if necessary, to fight a nuclear war-at-sea by providing a hedge

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The Navy is committed to modernizing the Navy's theater nuclear forces through vigorous and sustained efforts.

(U) In January 1988, the Navy completed a review of its TNW capability. The study stressed the need to make long-term decisions this year and during the FY 1990 Program Objective Memorandum process that are fiscally supportable and consistent with a clear Navy TNW policy.

NAVY ANTI-AIR WARFARE (AAW)

The current Navy nuclear Anti-Air Warfare (AAW) capability is provided by the W45Y1, TERRIER BTN (Beam-Riding, Tail-Guided, Nuclear Round) system.

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NAVY ANTI-SUBMARINE WARFARE (ASW)

Currently, the Navy has the B57 air dropped nuclear depth bomb, the W44 surface ship-launched nuclear Antisubmarine Rocket (ASROC), and the W55 submarine-launched nuclear Submarine Rocket (SUBROC) to perform its nuclear ASW mission. The B57 will be replaced with the nuclear depth/strike bomb discussed later in this statement. The Navy made a conscious decision long ago to retire SUBROC

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NAVY LAND ATTACK

TLAM/N. The Tomahawk Nuclear Land Attack Cruise Missile, or TLAM/N, greatly enhances the Navy's contribution to the U.S. deterrent posture by distributing Navy retaliatory striking power across a large number of naval platforms. Tomahawk complements the power of the aircraft carrier air wing and multiplies the effectiveness of the force at sea. TLAM/N will also contribute to the National Command Authority's ability to deter strategic conflict and will provide additional survivable assets for the nuclear reserve force. TLAM/N reached Initial Operational Capability (IOC) in June 1984, and is being installed on the following classes of ships: SSN-637 Sturgeon and SSN-688 Los Angeles class attack submarines; DD-963 Spruance and DDG-51 Arleigh Burke class destroyers; CGN-9 Long Beach, CGN-38 Virginia, and CG-47 Ticonderoga class cruisers; and BB-61 Iowa class battleships. At present over 50 Navy ships and submarines are certified to carry TLAM/N. Within the next 5 years, Deleted TLAM/N missiles will be deployed in Deleted ships and submarines.

Nuclear Depth/Strike Bomb. A new air-delivered nuclear bomb with strike and depth bomb capability is needed for our Naval air force. The Nuclear Depth/Strike Bomb is expected to enter Phase 3 engineering development this year. This Nuclear Depth/Strike Bomb, with modern safety and security features, is planned to replace the 25-year-old B57 tactical strike bombs and B57 depth bombs which will be retired Deleted Deleted This commonality will allow reducing overall stockpile numbers of fleet strike and depth bombs. The Nuclear Depth/Strike Bomb has an IOC of Deleted

NAVY STRATEGIC NUCLEAR WEAPONS

TRIDENT II (D-5) W88. The TRIDENT II (D-5) missile is now in its fifth year of full-scale engineering development, and completed its ninth flight test in January 1988. DOE is developing the W88 warhead for this missile.

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the D-5 will provide our survivable, sea-based strategic force with greatly improved hard target kill deterrent capability. D-5 will first become operational when it goes to sea in the ninth TRIDENT submarine from its home base at Kings Bay, Georgia, in December 1989. Subsequent new construction TRIDENT SSBN will be D-5 equipped.

(U) The original eight TRIDENTs will be backfitted with the D-5 systems during regularly scheduled overhauls. The submarine base at Bangor, Washington, will be equipped to support D-5 by 1994 as we proceed toward an all D-5 TRIDENT force.

AIR FORCE

(U) The Small ICBM warhead has been undergoing Phase 3, development engineering, to modify the PEACEKEEPER warhead for this mobile delivery system. This study has been placed on hold while preserving the option for the next administration to continue the Small ICBM development program. The PEACEKEEPER Rail Garrison warhead is planned to be the same as the silo-launched warhead, and it is not anticipated to require any further warhead development effort. Before any funds from the Department of Energy's budget can be spent on the production of additional PEACEKEEPER warheads, Congressional restrictions imposed in FY 1986 must be lifted.

The SRAM II warhead has entered engineering development and is in step to support the planned IOC of the SRAM II missile. The fielding of this system is crucial to our strategic modernization program, and in addition, it is imperative that the current SRAM-A warhead be retired *Deleted*

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Recent analyses by the intelligence community indicate that the Soviets are working to expand or further harden

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facilities. Some underground facilities may be Deleted

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relatively invulnerable to weapons currently in the strategic inventory.

Earth Penetrating Weapons offer the capability to place at risk these Deleted facilities. Recommendations of a Phase 2 weapon feasibility study regarding potential interim and long-term options, expected in March, will be considered by the senior staffs of the DoD and the DOE.

UNDERGROUND TESTING

(U) The Department of Defense joins in thanking the Congress for its defeat of FY 1988 legislation aimed at further limiting our ability to test nuclear weapons. President Reagan long has taken a constructive and pragmatic approach to nuclear testing limitations, as demonstrated by several U.S. initiatives over the past several years aimed at achieving the necessary effective verification for the existing, but unratified, TTBT and PNET. The U.S.-Soviet joint statement of September 19, 1987, represents progress toward that goal, since the Soviets now have agreed that the first step in nuclear testing negotiations must be agreement on measures that would provide effective verification for the TTBT and PNET.

(U) Since the Nuclear Testing Talks (NTT) began in Geneva last November, we have agreed that a Joint Verification Experiment (JVE) could be useful in making progress toward agreement on effective verification measures for the TTBT and

PNET, and we have defined the overall concept of a JVE. The concept is that a JVE would take place at the test site of each side and would provide opportunities to measure the yield of nuclear explosions using techniques proposed by each side. The U.S. method, of course, is CORRTEX--the most accurate technique we have identified for TTBT and PNET verification--and through the JVE we hope to provide to the Soviet Union all the information needed for Soviet acceptance of U.S. use of CORRTEX for TTBT and PNET verification. In order to enhance prospects for designing and subsequently conducting a JVE, the sides exchanged familiarization visits to the other's test site in January. Those visits considerably increased each side's understanding of the practical problems associated with conducting a JVE. Both negotiating teams returned to Geneva in mid-February to begin work on the design of the JVE, which involves very complex technical questions.

(U) Our national policy supports a comprehensive test ban (CTB) as a long-term objective of the U.S. However, this goal cannot be achieved until a time when we need not depend on nuclear deterrence to ensure international security and stability, and when we have achieved broad, deep, and verifiable arms reductions, substantially improved verification capabilities, expanded confidence building measures and a greater balance in conventional forces. Our national defense strategy is based upon the principle of deterrence using nuclear weapons as the cornerstone. This strategy is effective only when there is no doubt in our minds and in the minds of our adversaries about the effectiveness of our nuclear weapon stockpile. Underground testing is the only method we have of establishing the credibility of our nuclear deterrent.

(U) Nuclear testing is essential to our nuclear deterrent in several important ways. First, it allows us to ensure that the highest possible standards for warhead safety and security are satisfied. Indeed, a substantial portion of our testing program since 1962 has gone toward enhancing the safety and security of nuclear weapons.

(U) Second, nuclear testing is vital for establishing and maintaining confidence in the operability and reliability of nuclear weapons. We have learned through hard experience that there is no substitute for confirming our calculations about how material and equipment behaves under the extreme conditions associated with a nuclear explosion.

The number of nuclear tests conducted by this country during FY 1988 will be less than one-fifth the number averaged during the late 1960's. During the same period, the number of nuclear systems in the stockpile has not changed appreciably. This trend is most disturbing when given our experiences

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They were both found to have problems not anticipated by the laboratory designers and were only discovered during nuclear tests. Historically, approximately 80 percent of all nuclear tests have been directly related to gaining confidence in designs intended for stockpile.

(U) Third, the United States strives to maintain the highest level of military effectiveness in its nuclear weapons at the lowest yields possible, consistent with attainable delivery system accuracies and hardness of Soviet targets. Through testing we are able to assure that new weapons meet ever more stringent requirements for the minimization of undesired collateral damage. Thanks to the knowledge gained from nuclear testing, the aggregate explosive power of our current nuclear stockpile is only about one quarter that of 1960.

(U) Fourth, nuclear testing allows us to have confidence in the survivability of our warheads, and in the effectiveness of our warhead against increasingly hardened Soviet targets.

(U) Responsibility for managing the nuclear weapons effects research and nuclear weapons effects test programs is assigned to the Department of Defense's Defense Nuclear Agency (DNA). Underground nuclear effects tests fielded by DNA (the nuclear explosives are provided by DOE) are essential to our nuclear weapons programs. Historically, our underground nuclear weapon effects test program was designed to permit the development of technologies that protected national security systems against Soviet nuclear attack and the certification of final designs of military systems employing those technologies. Of equal importance, the effects test program defined the requisite military effectiveness of our warheads. However, the current funding levels have constrained our underground nuclear weapon effects program to its lowest level of activity in nine years.

(U) The DoD, based upon the testimony of the national laboratory directors, recognizes our dependence on continued nuclear testing at the current 150kt threshold limit. These tests are required for the modernization of weapon systems to hold at risk a changing target base and to demonstrate survivability, effectiveness, reliability, and performance. The requirement for testing derives from the key position nuclear weapons occupy in our defense strategy and not from any perceived flaws in the current stockpile. Further test limitations, in the absence of significant changes in our nuclear deterrent requirments, will weaken the ultimate goal of our nuclear arms: deterrence of war.

SUMMARY

(U) In summary, let me emphasize to you the importance of the following points:

- We must continue to understand that the foundation of our deterrent posture is, and will continue to be for the foreseeable future, our nuclear weapons capability, including the ability to conduct nuclear tests. Nuclear testing remains an integral and essential part of our deterrent posture.

- We must continue modernizing both our strategic and our nonstrategic nuclear forces, including our short-range nuclear weapon systems in support of the NATO defense posture.

- We must maintain an ongoing, vigorous nuclear weapons program, including research, development, and testing along with both warhead and materials production.

(U) This concludes my formal testimony. I would be happy to answer questions.

STATEMENT OF JILL E. LYTLE, DEPUTY ASSISTANT SECRETARY FOR NUCLEAR MATERIALS, DEPARTMENT OF ENERGY

Mr. Chairman and Members of the Committee; I am Jill E. Lytle, Deputy Assistant Secretary for Nuclear Materials, within the Office of Defense Programs of the Department of Energy (DOE). It is my pleasure to provide testimony regarding the Department's budget request for the Nuclear Materials program in FY 1989. The responsibilities of my position include the production of nuclear materials for the nuclear weapons complex and the management and disposal of nuclear wastes from all of the Department's defense activities.

Nuclear materials production and defense waste management activities comprise a nationwide complex of nuclear production reactors, metal foundries, chemical processing plants and waste facilities that constitute a multi-billion dollar industry unto themselves. It is an industry with both unique hazards and important product requirements. The original technology and facilities for producing nuclear materials were placed in operation quickly in the 1940's to meet immediate military requirements. Most of the currently operating facilities were built in the 1950's and early 1960's. These dedicated facilities are the sole source of tritium and plutonium in the United States to meet national defense nuclear materials requirements. We, therefore, must always be mindful of maintaining the capability and reliability of these facilities while planning and developing new technologies and facilities to meet future requirements.

With your support we continually increased production in the early 1980's. We felt that Nuclear Materials Production (NMP) was back on the road toward reliable operation and sufficient capacities to meet defense requirements. However, the loss of C Reactor, the reduction in power level of the remaining SR reactors and the previous stand down of the N Reactor highlighted the fragility of the nuclear materials production complex.

It is very important to enhance our programs of productivity retention and improved facility maintenance as recommended in the National Academy of Sciences recent report on the production reactors. This will enable the program to maintain production capacity and capability. DOE and Congress must continue to work together to find solutions to the problems associated with these aging facilities and the increasingly stringent environmental, safety, and health and safeguards and security requirements.

Without these solutions or alternate sources for nuclear materials, the Nation's nuclear defense posture will be in jeopardy.

The level of activity in the Defense Waste and Environmental Restoration (DWER) program is increasing, requiring additional funding, due to the approaching completion of major facilities and the shift from storage to permanent disposal operations. The Department has made a commitment not to build new high-level waste storage tanks at the Savannah River Plant but to provide for a major waste immobilization facility, the Defense Waste Processing Facility (DWPF), as the appropriate step in moving towards geologic repository disposal. This plant is approximately 70 percent complete. The Waste Isolation Pilot Plant (WIPP) in New Mexico will demonstrate disposal of transuranic wastes. This facility is over 90 percent complete and is scheduled to begin operation in October of this year. In FY 1989, we have also provided funding for continuing design activities on the Hanford Waste Vitrification Plant (HWVP) in Washington which will provide for immobilization of wastes at the Hanford site. These facilities are all a part of the Defense Waste Management Plan submitted to Congress in June 1983.

Finally, Defense Programs is placing greatly increased emphasis on our obligations under the hazardous waste laws to cleanup environmental contamination at the defense production sites. Carried out in the past primarily as an overhead burden on our production operations, these important remedial actions have been elevated to full program status, as recommended by Congress, and now undergo explicit planning, budgeting and progress tracking.

(Chart 1) The Nuclear Materials FY 1989 request is $2.95 billion. This amount includes $2.01 billion for Nuclear Materials Production, and $0.94 billion for Defense Waste and Environmental Restoration.

NUCLEAR MATERIALS PRODUCTION

INTRODUCTION

Goals

(Chart 2) The principal goal of the NMP program is to provide nuclear materials to meet national defense requirements. In addition, we must maintain adequate production capability and capacity, at the same time continuing to support essential environmental, safety, and health, and safeguards and security requirements.

Nuclear Materials Requirements

The NMP program's primary responsibility is to meet the requirements for tritium, plutonium, and enriched uranium set forth in the Nuclear Weapons Stockpile Memorandum (NWSM) approved annually by the President. The President annually issues a National Security Directive approving the Nuclear Weapons Stockpile Plan and noting the planning projection as a point of departure for future stockpile plans. These forecasts are based on military needs of the Department of Defense (DOD) and DOE's ability to respond to these needs.

In addition to weapon requirements, the materials production complex also must satisfy the other government and civilian demands for nuclear materials. These total requirements are met from existing inventories, new production in our facilities, and through purchase of uranium enrichment services from the DOE Office of Uranium Enrichment. However, defense spending has been limited by the December 1987 budget "summit" between Congress and the Administration. This has led to a joint DOE and DOD effort, through the Nuclear Weapons Council, to define an integrated nuclear weapons program consistent with the budget ceiling. Analysis of the nuclear materials supply based on the revised force structure projections from DOD indicates that the need for new plutonium production is significantly reduced. As a result of the reduced requirements, a difficult decision had to be made to reduce the size of the materials production complex in a way that would assure its reliability and long-term capability.

N Reactor

(Chart 3) The N Reactor has operated since 1963 producing plutonium for both defense and reactor research and development, as well as byproduct steam for the generation of electricity. Since 1982, the reactor has played a key role in meeting the requirements for the production of weapon-grade plutonium. The reactor has been in a stand down condition since January 1987 so that the implementation of safety enhancements identified by the DOE and outside independent reviews could be accelerated.

Based on the latest plutonium production requirements, the Department felt that this demand could be met without the production of N Reactor. Therefore, the Department announced on February 16, 1988, its intention not to restart the N Reactor. The reactor will be defueled and placed in cold standby status. The Department will, however, complete the safety upgrades and reviews that are scheduled for completion prior to restart. These actions will allow the Department the option of restarting the reactor if national security requirements prompt an increased demand for plutonium and new production facilities are not available.

The majority of weapons production facilities are unique in the complex, and each is an essential element in the weapons production system. In the case of plutonium production, however, duplicate capability exists between the Savannah River Plant and the Hanford site. In the past, the capacity of both sites was needed to meet demand, and the redundancy also afforded greater assurance of a continued material supply at a time when aging of the reactor production facilities was becoming of more concern. Presently, however, a reduction of the plutonium production capacity through placing the N Reactor in cold standby is the most prudent action in response to the significant reduction in material requirements.

I will now briefly address the specific requirements for tritium, plutonium, and enriched uranium.

Tritium

The tritium in the weapons stockpile decays at the rate of about 5.5 percent per year. In order to maintain the effectiveness of the stockpile, the tritium components are exchanged and recycled. In addition to this recycle work, there are new weapons added to the stockpile that require tritium.

(Chart 4) This chart shows the cumulative new tritium which must be produced to satisfy all tritium demands, including decay and losses, through FY 1998. It is DOE policy to operate our production reactors to meet this tritium requirement before satisfying the requirements for other reactor products. This chart also indicates the annual equivalent full power reactors which must be used to meet these tritium requirements. The remaining capacity is used to produce plutonium.

Plutonium

(Chart 5) This next chart shows total amount of plutonium needed to satisfy the recently revised requirements and that expected to be available. The total current weapon inventory and production support pipeline contain [DELETED] of plutonium. Much of the plutonium required for building new warheads is obtained by reclaiming and recycling materials from the retired weapons returned by the DOD to the DOE. Material requirements which cannot be met from DOD returns or existing DOE inventories must be satisfied by new production.

Highly Enriched Uranium

(Chart 6) I also need to mention the supply of highly enriched uranium for U.S. weapons. The U.S. weapons program has operated within its existing inventory of enriched uranium for the last 24 years without having to obtain additional material from the uranium enrichment complex. This has been accomplished by recycling enriched uranium from retired warheads and using existing excess inventories. Although recycling continues, the current schedules for building and retiring warheads will make it necessary to purchase uranium to meet requirements in about FY 1992.

NAS Reactor Assessment

(Chart 7) In May of 1986, Secretary Herrington invited the National Academy of Sciences (NAS) and the National Academy of Engineering (NAE) to provide the Department with an independent assessment of safety and technical issues raised by the nuclear reactor accident at Chernobyl. The focus of this assessment was to be the Department's eleven Class A (greater than 20 MWt) reactors. This assessment was in addition to steps the Secretary had already initiated including:

- special safety review of the N Reactor;
- design review of the N Reactor and the Savannah River Plant reactors;

- accelerated Technical Safety Appraisals of the production reactors; and
- review by distinguished experts outside the Department to assess safety issues concerning N Reactor raised by Chernobyl accident.

At the beginning of the NAS/NAE review, the Department requested that the review committee bring any matters of immediate concern to the Department's attention so that appropriate corrective action could be taken promptly. The review committee did this once during their review, notifying the Department by letter in March 1987 of concerns with the Emergency Cooling System at the Savannah River Plant. The Department immediately took action to further reduce the power of the Savannah River Plant reactors to about 50 percent from the 75 percent level previously established by the Department as a result of similar concerns.

The results of the NAS/NAE assessment of four production reactors were published in October 1987. The report entitled "Safety Issues at the Defense Production Reactors" contained a number of observations, conclusions, and recommendations regarding safety at these reactors as well as the Department's process for managing and implementing reactor safety.

Shortly after receiving the report, Secretary Herrington announced a number of actions to be taken to respond to the recommendations of the report including:

- establishment of an independent oversight panel;
- development of an action plan to strengthen DOE's internal safety oversight;
- development of an action plan for revising the DOE safety orders and standards; and
- development of an action plan to resolve each of the technical recommendations in the report

Of particular relevance to the technical recommendations are the conclusions and recommendations described under the "Technological Vigilance" issue in the DOE "Safety Framework" section of the NAS/NAE Report. The Department's production reactor operating contractors are undertaking aggressive programs to enhance the technical competence and capability devoted to the reactors as well as the experimental and analytical base to support reactor safety. The Department is also evaluating the actions needed to strengthen its own in-house technical capability to manage the safety of its own production reactors in addition to strengthening its separate oversight function.

DOE's implementation of a number of the technical recommendations must be closely integrated with the activities of the Assistant Secretary for Environment, Safety and Health (ASEH) in response to the recommendations in the DOE "Safety Framework" section of the NAS/NAE report; e.g., revisions of DOE orders and development of DOE policy planned or underway in the areas of emergency planning, aging, backfitting, training, incident analysis and trending, probabilistic risk assessment, and severe accidents.

During the review committee's activities from August 1986 through October 1987, the Department completed a number of its own reviews as I described earlier. As a result, ongoing and planned (but not yet initiated) programs were strengthened or accelerated and new programs were initiated at N Reactor and the Savannah River Plant reactors to further enhance safety understanding and the safety of these reactors. These include the Safety Enhancement Program and Accelerated Safety Enhancement Program for N Reactor and the Severe Accident Assessment Program and the Integrated Safety Evaluation Program for the Savannah River Plant reactors. The technical issues identified in the NAS/NAE report, for the most part, were being considered in these or other ongoing programs, and the observations and recommendations made by the committee will be of major assistance in improving and strengthening these programs. In many cases, relevant results from these programs were not available until after the review committee had completed its analysis of an issue. The existence of these comprehensive safety activities has enabled the Department, in many cases, to modify or refocus existing programs to address the NAS/NAE report recommendations rapidly and without the need for significant additional resources in the near term.

The NAS/NAE report contained no recommendations nor did DOE's review identify any technical issues warranting immediate corrective action or further restrictions over and above the power reductions implemented at the Savannah River Plant reactors as a result of uncertainties in the ability of the emergency cooling system to respond to a worst case loss-of-coolant accident.

Many of the activities involve potential future analyses, tests, upgrades, etc., which can only be fully defined after completion of earlier analyses, designs or tests. For example, scoping of the increased maintenance and modernization costs can only be done after definition of new programs, criteria and facilities, since these costs are so interrelated with existing modernization and plant maintenance planning and programs that a meaningful total or incremental cost cannot be identified.

It is expected, however, that further substantial increased effort will be required to support the NAS/NAE recommendations, similar to that experienced with the ongoing implementation of the initiatives to strengthen the Department's environmental, safety and health performance implemented earlier by Secretary Herrington.

Implementation of the recommendations has been given a high priority within the Department; therefore, the timely completion of many of the activities has been made possible through deferral of lower priority work. In fact, as the NAS/NAE review progressed and issues were identified, programs were often refocussed and modified to deal with the issue well before the report was completed and provided to DOE. As future budgets are defined and progress is made on improving the definition of required actions for implementation, the Department will update its plans periodically and track the implementation actions.

FY 1989 Budget Request

(Chart 8) Turning now to the FY 1989 budget, we are requesting slightly over $2 billion in support of NMP activities. This is approximately an 11 percent increase over FY 1988, but only a 9 percent increase for the 2-year period from FY 1987.

(Chart 9) Significant growth is included for environment, safety, and health activities. This increase is necessary to adequately address safety issues and to ensure compliance with applicable State and Federal regulations. Addressing the priority need to maintain adequate capability and capacity at our remaining reactors requires significant funding over current levels. The NMP program has had to take a hard critical look at core program activities to maintain fiscal constraint.

(Chart 10) The next chart shows a crosscut of our budget request broken down into important program activities. I will address each in detail.

CORE PROGRAM

Base Activities

(Chart 11) The major component of our request is for base activities. Base activities include facilities that must continue to operate for the production of nuclear materials. Of the request, approximately $1 billion is needed to support base activities.

Meeting the objectives of the program requires operation of reactor feed materials facilities at Fernald and Oak Ridge; operation of the three Savannah River Plant reactors; operation of chemical processing facilities at the Savannah River Plant, Hanford, and Idaho Falls; ongoing technology development activities; and operation of utilities and other site support facilities. The program also supports processing of Naval and research and development reactor spent fuel returned to Idaho, recovery and processing of scrap nuclear materials to supplement new production, and other Department, government, and industry requirements.

Savannah River Plant Reactors

In FY 1989, three Savannah River Plant reactors (L, P, and K) will be operated to produce the necessary tritium and plutonium to support requirements. The C Reactor will remain in cold standby due to the unrepaired cracks in the reactor tank. The fuel fabrication facilities will operate on a single shift per day to support these reactors. These reactors are now operating at reduced power, but a major program is underway for return to full power operation.

Processing Operations

Processing of the reactor fuel and targets separates the plutonium and tritium into product form for use in nuclear weapons. Processing also includes the purification of scrap plutonium that is unavoidably generated in plutonium processing operations. Plutonium is processed in a vast complex of aging facilities, each of which plays a vital role in materials production. Maintaining and upgrading these facilities for long-term operation while at the same time continuing to meet production requirements is a special challenge. With the continued support of this Committee and with the sharing of similar processing capabilities between NMP and DOE's

Office of Military Applications to our mutual benefit, we have been able to meet materials requirements. Continued upgrading of these processing facilities and preventive maintenance will be required to maintain processing capabilities and to deliver plutonium to our weapons program.

Fuel-grade plutonium for blending at the Savannah River Plant was recovered from N Reactor fuel processed in PUREX in FY 1987. The PUREX Plant is currently processing N Reactor fuel containing weapons-grade plutonium. This campaign will continue throughout FY 1988. The Plutonium Reclamation Facility (PRF) operated from July through December 1987 to process selected plutonium residues. Preparations are being made to operate the Remote Mechanical "C" (RMC) line to produce metal from the purified plutonium from PUREX and PRF operations. The RMC Line is expected to resume operations later in FY 1988, and the plutonium metal product will be shipped to the Rocky Flats Plant for weapons programs use.

As I stated above, production of plutonium in N Reactor is not required currently because of a significant reduction in plutonium requirements. However, even with N Reactor in cold standby, the processing facilities at Hanford must continue to be operated. From 1972 to 1983, the PUREX fuel processing facilities were in standby. Spent fuel discharged from N Reactor during this time was stored in cooling basins at Hanford where much of it remains today. About 1750 MT of fuel containing [DELETED] of fuel-grade plutonium, in addition to over 700 MT of fuel containing over [DELETED] of weapons-grade plutonium, is in storage and will be processed in the PUREX facility. In addition, with the placement of N Reactor in cold standby, the irradiated fuel still in the reactor will be discharged and processed. The weapons-grade plutonium will be separated and used without further processing in defense programs; the fuel-grade plutonium will be blended or processed in the Special Isotope Separation (SIS) facility to provide weapons-grade plutonium. The Plutonium Finishing Plant

(PFP) will continue to operate to purify scrap plutonium generated in our scrap processing operations, and to convert the pure plutonium from scrap processing and from fuel processing to the required metal forms.

Restoration and Retention

(Chart 12) The potential for facility related production curtailments, such as those that have occurred during the past year, has been recognized for some time. Projects were initiated as early as FY 1981 to address the emerging problems of plant aging and marginal capacity. That advanced planning paid dividends. Thanks to production increases obtained through the L Reactor Upgrade, the Restoration of Production Capabilities, and other early projects, we have been able to meet the requirements placed on the complex the past few years.

The problem of overtaxed, obsolete facilities is, however, not solved. Significantly more must be done if we are to continue to meet production requirements in the future.

The outyear supply projections that I showed earlier are based on the timely undertaking of a number of key projects. I would like to discuss these next.

The Productivity Retention Project is directed at two of our most immediate needs: improved plant operational availability and cost efficiency. The output of many of our facilities is declining due to excess maintenance downtimes. Old, worn-out equipment breaks and requires constantly increasing levels of repair. These repairs halt operations and inhibit production. In the case of nuclear facilities, even a minor breakdown can have a significant impact because of the decontamination that must be performed prior to an actual repair. Further, more stringent safety and environmental release regulations have come into effect since the plants were originally constructed. Meeting these new standards poses an interesting challenge to facilities built over 30 years ago.

The total cost of correcting these deficiencies and improving the efficiency of our principal facilities is estimated to be about $410 million. The project has been divided into four separately introduced phases in order to accommodate budget constraints. We are requesting approximately $72 million in FY 1989 to continue Phases I through III and initiate Phase IV.

While the Productivity Retention Project represents a substantial investment, the cost will more than be repaid through outyear savings. Without this project we will have to use high staffing levels and other uneconomic approaches that will drive up operating budgets.

The Facility Restoration Project was begun in FY 1981 and is the oldest of our three projects to maintain production capacity. It is now in the latter stages of construction. Over two-thirds of the subprojects have already been completed and, as mentioned previously, are contributing to our production output. Approximately $6 million is requested in FY 1989 to complete the final subprojects.

Special Isotope Separation (SIS)

(Chart 13) The SIS Project will provide a source of plutonium that is technological diverse from production reactors and independent of the issues associated with these reactors. SIS will also provide the flexibility to more readily respond to potential increases in the demand for weapon-grade plutonium.

SIS employs the Atomic Vapor Laser Isotope Separation (AVLIS) process, which utilizes laser energy to separate the isotopes of plutonium. More specifically, lasers are used to remove undesired minor isotopes from Government-owned plutonium to support defense applications. This process is being developed for the Department of Energy by the Lawrence Livermore National Laboratory.

The two major SIS activities are process development and production plant design and construction. Integrated demonstrations will include both full-power single isotope and reduced-power three isotope separations using plant scale equipment. These demonstrations will be supported by prototypic balance-of-plant plutonium processing. The Department has taken the position that substantial plant construction will not be initiated until completion of a review and assessment of demonstration program results.

As a result of Congressional support for the SIS project, the planned funding for FY 1988 was increased from $56.0 million to $95.8 million. The FY 1989 budget requests a total of $101.4 million to continue research and development on SIS technology and definitive design and engineering associated with the process and the production facility. In FY 1988, following the Environmental Impact Statement Record of Decision, preparation of the site for physical construction will begin. The start of construction for process facilities, as well as initiation of major long-lead procurements, is scheduled to begin in FY 1989 after key results are in from the development program. The current total estimated cost of the project is $550 million and a total project cost, which includes operating and support equipment, is approximately $1 billion.

ENVIRONMENT, SAFETY, AND HEALTH

(Chart 14) I would like to talk about what the NMP program is doing to support the Department's commitment to environment, safety, and health (ES&H). The Department's continuing policy is to conduct its operations in an environmentally safe and sound manner. DOE is committed to taking actions necessary to comply with applicable environmental statutes, regulations, and standards, while providing nuclear materials required for national defense. The FY 1989 Nuclear Materials Production budget request of $434.6 million for environmental, safety, and health activities demonstrates this emphasis and commitment.

Compliance actions are underway to meet the requirements of the Resource Conservation and Recovery Act, the Clean Air Act, the Clean Water Act, and the Comprehensive Environmental Response, Compensation and Liability Act. To assure efficient usage of limited resources to comply with the evolving multitude of Federal, State, and local environmental requirements, the Office of Nuclear Materials is preparing long-range plans to address ES&H concerns. The ES&H long-range plans will be updated on an annual basis to reflect changing requirements/operations and funding availability.

At the Feed Materials Production Center (FMPC), Fernald, Ohio, FY 1989 construction project efforts will: provide significant improvements in controlling water contamination; modify and upgrade facility ventilation systems and dust collection systems to reduce the risk of airborne contamination; provide for the improved control of on-site activities such as material handling systems that have potential for inadvertent contamination of personnel and the environment; and construct general health and safety improvements including an offsite emergency alarm system. DOE is aggressively pursuing assessment and planning efforts to determine needed corrective actions, and to develop a schedule for implementation and the associated funding required. Renovation activities for FMPC were initiated in FY 1982; however, the majority of the activities began in FY 1985 and will continue through the 1980's into the mid 1990's. DOE is preparing an environmental impact statement on renovation activities to obtain public input to assist DOE in its decision making process. It is DOE's goal to comply with applicable ES&H requirements for FMPC operations and to reduce operational risk and environmental releases to as low as reasonably achievable levels.

The production complex must operate in an environmentally acceptable manner while providing the nuclear materials required for national defense. The FY 1989 budget request for ES&H activities provides for long-term solutions for priority problem areas.

SAFEGUARDS AND SECURITY

(Chart 15) In FY 1989, we are requesting $176.1 million in safeguards and security funding to address essential needs. Our request includes only one new project for NMP, a security project at the Savannah River Plant which will provide protected areas for the 221-F and 221-H canyon buildings. The protected areas will consist of an intrusion detection and assessment (IDA) zone and two entry control facilities for personnel access control.

[DELETED]

NEW PRODUCTION REACTOR (NPR)

(Chart 16) The Department's long-range plans for the production of special nuclear materials assume that the NPR and supporting facilities will replace existing production reactor capacity. The primary mission for an NPR would be to assure that goal quantities of tritium can be produced to sustain our nuclear weapons stockpile. The NPR would also be capable of producing plutonium, if this proves necessary.

The funding granted by Congress for FY 1988 will permit studies of alternative sites and technologies for an NPR and preparation of a final report designating a preferred site and preferred technology. In FY 1988, we will also initiate the necessary environmental studies, leading to initiation of an Environmental Impact Statement for the NPR. The Department has asked the Energy Research Advisory Board to evaluate the alternative reactor technologies. The reactor technologies being reviewed for the NPR include: (1) Low-Temperature Heavy Water Reactor; (2) Light Water Reactor; (3) High-Temperature Gas-Cooled Reactor; and (4) Liquid Metal Reactor.

We have also established a Site Evaluation Team to evaluate alternative sites. The sites being considered for the deployment of an NPR include the three nuclear materials production sites presently involved in reactor operations and fuel processing. These are: (1) the Hanford Site, Richland, Washington; (2) the Idaho National Engineering Laboratory, Idaho Falls, Idaho; and (3) the Savannah River Plant, Aiken, South Carolina.

The findings of both the Energy Research Advisory Board and the Site Evaluation Team will be completed in FY 1988. A report to Congress providing the status of the site and technology evaluations will be provided in May 1988. A final report providing the Department's recommended acquisition strategy, including the preferred technologies and preferred sites, will be provided in July 1988. The final report will include the number of production reactors required and a time schedule for their acquisition, construction, and operation.

Safety will be a primary design consideration for the NPR and will be integrated early into the design. The underlying NPR safety philosophy will address both accident prevention and accident mitigation, including, where applicable, the ability of the containment structure to withstand severe accidents beyond the design basis. To ensure that the level of safety is achieved, an approach consistent with the Nuclear Regulatory Commission (NRC) safety review process and safety requirements and DOE orders will be used. This approach will result in a level of safety that meets or exceeds that afforded by licensed commercial power reactors.

The funding requested for FY 1989 will permit work on the EIS to proceed. The Department will also begin conceptual studies for an NPR in FY 1989 in accordance with the acquisition strategy to be reported to Congress in FY 1988. Cost studies will also be completed to provide a firmer estimate of project cost. Current estimates for cost are 3 to 5 billion dollars. Schedule estimates will also be refined. The current completion target date is 1998.

NAVAL REACTORS SUPPORT

(Chart 17) The Nuclear Materials Production program budgets for the separative work to produce highly enriched uranium from the Department's gaseous diffusion complex for the Naval Reactors program. In FY 1989, the Naval Reactors program requires [DELETED] of uranium. This highly enriched uranium will be used for fabrication of naval propulsion reactor cores and to continue naval fuel production in the new facility at the Savannah River Plant. The total FY 1989 Naval Reactor support request is $169 million. These funds reflect a [DELETED] decrease from the FY 1988 request. The cost of the uranium to be provided to Naval Reactors is dependent on the separative work price charged by the Office of Uranium Enrichment. The proposed price for FY 1989 is 60 percent higher than the FY 1988 price.

NEW SAVANNAH RIVER PLANT OPERATING CONTRACTOR

On October 29, 1987, the Du Pont Company notified DOE that it would not continue operations at SRP after its current contract expires on September 30, 1989. Secretary of Energy Herrington has decided that DOE will have a single contractor operate its SRP and has initiated source selection process. We are currently in the process of estimating incremental FY 1989 funding requirements to cover "one-time" pension and other benefit costs incurred as a result of contract termination. The Department is still considering a plan to address these costs.

SUMMARY

In summary, there are a number of challenges currently facing the Nuclear Materials Production Complex:

- Maintaining production in aging facilities including those undergoing renovation and major safety upgrades;

- Maintaining required production levels within constrained budgets while accommodating increased ES&H and safeguards and security funding needs; and

- Developing sufficient budget and support to begin and sustain new initiatives required to assure a viable production complex into the next century.

We are taking aggressive actions to meet these challenges and look forward to the continued close communication with and support of the Congress which is essential to the success of these actions.

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION PROGRAM

INTRODUCTION

Goals

(Chart 18) The Defense Waste and Environmental Restoration (DWER) program's principal goal is to provide essential support for nuclear materials production requirements through the safe and environmentally acceptable management of radioactive and hazardous wastes.

The DWER program must maintain the capability and capacity to manage these wastes in a routine, safe, and cost-effective manner. The program also ensures the availability of safe, secure, and efficient means of transporting radioactive and hazardous materials. Substantial resources are also called out for environmental restoration; i.e., investigation and remediation of environmental contamination at presently inactive Defense Programs sites. The goals are to achieve compliance requirements of applicable laws and regulations.

In June 1983, the President submitted to you the Defense Waste Management Plan which provided a baseline for permanent disposal of high-level waste and transuranic waste. Our FY 1989 programs continue implementation of that Plan.

The key provisions of the Plan included: (1) construction and operation of the Defense Waste Processing Facility (DWPF) at the Savannah River Plant; (2) construction of the Waste Isolation Pilot Plant (WIPP) located near Carlsbad, New Mexico, and performance of research and development for demonstration of geologic disposal of transuranic waste; (3) the construction and operation of the Hanford Waste Vitrification Plant (HWVP) to process high-level waste at Hanford for disposal in a Federal geologic repository; and (4) construction and operation of transuranic waste processing facilities at the Richland, Savannah River, Oak Ridge, and Idaho sites, so that transuranic waste from those sites may be certified and shipped to WIPP.

Implementation of the Defense Waste Management Plan requires additional operating funds in FY 1989. The continuation of construction and startup activities at the DWPF and the operation of the WIPP facility, beginning in October 1988, result in increased fiscal needs in FY 1989. I will talk about our specific site plans in just a moment.

The decision in 1983 to move from interim waste management to terminal disposal was sound and prudent. Implementation of this plan, however, led to minimizing expenditures for interim waste management facilities. Timely startup of new facilities which will support disposal, such as the DWPF, is clearly necessary to support continued production of nuclear materials.

RADIOACTIVE WASTE INVENTORIES

Radioactive Waste Types

(Chart 19) Radioactive wastes are primarily of three types--high-level, transuranic, and low-level--and are generated by DOE defense activities, the Naval nuclear propulsion program, and other DOE research and development work.

High-Level Waste

High-level waste is, in general, highly radioactive liquid waste resulting from plutonium production and enriched uranium recovery operations at the Savannah River Plant, Idaho, and Richland. Our objective is to achieve disposal of high-level waste by immobilization, shipment to, and disposal in a commercial geologic repository. Due to successful evaporation and concentration efforts at Hanford and the Savannah River Plant, the actual volume of stored high-level waste has increased by only about 3.7 million gallons, despite higher generation rates. Such efforts help to minimize the need for new interim waste storage tanks pending operation of immobilization facilities.

Transuranic Waste

Transuranic waste contains the long-lived, radioactive elements beyond uranium in the periodic table. The principal element in such waste is plutonium. The DOE orders allow other radionuclides to be managed as transuranic waste if the potential long-term hazards indicate that such management is warranted. The objective of the plan with regard to transuranic waste is to end interim storage and demonstrate disposal in the WIPP.

Low-Level Waste

Low-level waste is radioactive waste not classified as high-level waste, transuranic waste, or spent nuclear fuel. The Department generated and disposed of about 97,000 cubic meters of this waste during the past year.

Waste Inventories

(Chart 20) Defense Waste and Environmental Restoration manages the disposed and stored defense nuclear waste. The next chart shows the volume of waste that has been generated from almost 40 years of nuclear materials production activities.

We are generating increasing quantities of high-level waste in the Nuclear Materials Production program. In addition, production activities added about 6,000 cubic meters of transuranic waste during the past year.

FY 1989 BUDGET REQUEST

(Chart 21) I would now like to address FY 1989 funding needs. Our request for FY 1989 is $936.5 million, a 5 percent increase over FY 1988.

(Chart 22) The next chart depicts the impact that these major program components have on the total budget. Our operating expenses are increasing because we are adding a new dimension to our program--startup of DWPF in FY 1990 to process high-level waste for disposal and startup of WIPP in FY 1989 to demonstrate disposal of transuranic waste. We will continue to effectively manage wastes at all Defense Programs sites, and continue to progress in the development, construction, and operation of facilities outlined in the Defense Waste Management Plan, such as the HWVP. We are also increasing Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Conservation and Liability Act (CERCLA) hazardous and mixed waste compliance actions.

(Chart 23) I have included this next chart to show funding for the major program activities within DWER. I will now describe each of these activities in more detail.

ENVIRONMENTAL RESTORATION

(Chart 24) In FY 1989, the Environmental Restoration Program is requesting $120.9 million. This program was initiated by Congressional action in the FY 1988 budget, based mainly on the consolidation of funding which had been planned for remedial action activities under several Defense Programs offices. The objectives of the Environmental Restoration Program are to identify, characterize and restore all inactive waste sites at Defense Programs installations and to ensure compliance with applicable laws and regulations in the remediation of these waste sites. Many remedial actions at DOE sites have been incorporated into strict compliance schedules through either the RCRA permitting process or through consent orders and compliance agreements with the Environmental Protection Agency and State regulators. Cleanup of the balance of the inactive sites must be performed under the requirements of the CERCLA.

The Environmental Restoration Program includes three phases which tie to the CERCLA requirements: (1) preliminary assessments and site inspections, (2) remedial investigations and feasibility studies, and (3) remedial actions. Included as a part of this program are the Defense surplus facility decontamination and decommissioning program and remediations associated with pre-1970 buried suspect transuranic wastes at Defense Programs facilities.

In FY 1989, the Preliminary Assessment/Site Investigation phase of the program will focus on newly prioritized sites, including the pre-1970 buried suspect transuranic waste sites at Idaho. Most of the other Defense Programs sites will have completed this preliminary phase during FY 1988, as required by the CERCLA amendments.

The Remedial Investigation/Feasibility Study phase of the program will focus on continuing the investigations of the highest priority Defense Programs sites and initiating feasibility studies of alternative remedial action designs as directed by consent orders and compliance agreements. Subsurface investigation of the Idaho pre-1970 buried suspect transuranic waste sites will continue, as will investigation of Hanford inactive waste sites, including characterization of the single-shell tank farms. At Oak Ridge National Laboratory, investigation of the main site, solid waste storage areas, hydrofracture facility and offsite contamination areas will continue. Remedial action waste cleanup design will be initiated at the Feed Materials Production Center as required under the consent order and compliance agreement.

Characterization of the Chestnut Ridge and Bear Creek Valley disposal areas at the Oak Ridge Y-12 Plant will continue as required under the plant RCRA permit. At the Savannah River Plant, development of closure plans and remedial action design efforts will continue for the mixed waste burial grounds and seepage basins, as required by RCRA permit provisions.

Remedial investigation implementation will continue at Rocky Flats, Sandia Livermore, Pantex, Kansas City, Pinellas, Los Alamos, Sandia Albuquerque, and Mound. The Lawrence Livermore Laboratory main site and Site 300 remedial investigations and feasibility studies will continue on a schedule consistent with the State compliance order. A final EIS on the surplus production reactor decommissioning project at Hanford is also planned for FY 1989. These reactors were shut down between 1964 and 1971.

Site remediation activities will be implemented in FY 1989 at the most urgently needed locations with consideration of site readiness for corrective actions. Interim mitigation measures at the buried suspect transuranic waste sites at Idaho will be continued, and remedial actions will be initiated at the Idaho central facilities and chemical processing plant disposal areas in accordance with the consent order and compliance agreement. The closure demonstration for an Oak Ridge National Laboratory solid waste storage area will be continued as will interim maintenance and stabilization actions for the Feed Materials Production Center waste pits and silos. At the Oak Ridge Y-12 Plant, closure activities including installation of caps for land disposal units will continue. Interim remedial actions at Hanford will continue, including single-shell tank stabilization and isolation, and the decommissioning of the 105F reactor building at Hanford will be initiated. At Lawrence Livermore Laboratory, construction will be completed on an extraction and treatment facility for reclamation of contaminated groundwater both on and offsite, in accordance with the State compliance order. Earth work at the Grand Junction site will be initiated in FY 1989. In addition, development of innovative clean-up technology will be pursued in cooperation with the Environmental Protection Agency and the Department of Defense under the Superfund Innovative Technologies Program.

Under the Environmental Restoration Program, Defense Programs is focusing significant resources to assure that previously uncontrolled hazardous and radioactive substance release sites are eliminated or are reduced to prescribed levels. Since these remedial actions are conducted under schedules established by law and at many sites also through consent orders and compliance agreements, it is critical that support for these important environmental activities be continued.

WASTE OPERATIONS AND PROJECTS

The principal objectives of this program are the safe and environmentally acceptable management of existing and newly generated waste from nuclear materials production; weapons production, research, development and testing; the naval nuclear propulsion program; and implementation of processing and disposal activities for high-level and transuranic waste. The program includes the operation and maintenance of high-level waste storage tanks, bins, and related processing and storage facilities at Richland, the Savannah River Plant, and Idaho; the operation and maintenance of low-level waste burial grounds at the Savannah River Plant, Oak Ridge, Idaho, Richland, Los Alamos National Laboratory, Sandia National Laboratory, and the Nevada Test Site; and the retrievable storage of transuranic waste at various sites. In addition, the program is responsible for the construction and operation of facilities to prepare transuranic waste and high-level waste for disposal.

At INEL in FY 1989, high-level waste management activities, primarily in support of the Naval nuclear propulsion program, will continue. Planned maintenance of the New Waste Calcining Facility (NWCF) was completed in FY 1987 and the facility has been operating since to solidify the backlog of liquid waste stored in tanks.

Construction of the Processing Experimental Pilot Plant (PREPP) has been completed. PREPP will process transuranic waste prior to certification for emplacement in the WIPP and is still undergoing testing. In its third full year of operation, the Stored Waste Examination Pilot Plant, INEL's transuranic waste examination and certification facility, will examine 5,000 drums of waste to assure a backlog of certified waste for WIPP when it opens in FY 1989.

Defense Waste Processing Facility

(Chart 25) Our request for FY 1989 for the DWPF operations and construction is $210.2 million with an additional $3.8 million for supporting research and development activities. The DWPF will immobilize defense high-level waste at Savannah River for storage, and eventual transportation to, and disposal in a geologic repository. The radioactive fraction of the high-level waste will be immobilized directly in borosilicate glass. The decontaminated salt fraction of the waste will be solidified as saltstone and disposed of at the Savannah River Plant as a low-level waste. When the DWPF is operational in late FY 1990, we will begin to work off the backlog of high-level waste from production operations at the Savannah River Plant, reaching a steady-state operation in about 15 years. DWPF saltstone facility operations will commence in late FY 1988.

In FY 1989, preoperational activities will continue at an increased pace in anticipation of FY 1990 vitrification facility operation. These preoperational activities include equipment and process development and testing; training and preparation of technical manuals; and operability testing of equipment. Also in FY 1989, operation of the DWPF saltstone facility will continue. FY 1989 will represent the first full year of saltstone facility operation, and preoperational activities at the vitrification facility will continue leading to operation in late FY 1990.

It is essential that the current schedule for DWPF be maintained. Double-shell tank space for newly generated high-level waste is very limited, and we must continue to remove waste from the old tanks before problems develop. Delay in the DWPF project, including the start of saltstone operations, will adversely impact our ability to support nuclear materials production.

Waste Isolation Pilot Plant

(Chart 26) We are requesting $113.1 million for the first year of WIPP operations in FY 1989 with an additional $19.2 million for supporting research and development activities. The WIPP is a research and development facility to demonstrate the safe disposal of radioactive waste from national defense programs. The WIPP is authorized by Public Law 96-164 and is exempt from licensing by the Nuclear Regulatory Commission. Consistent with the stipulated agreement between New Mexico and the DOE, this request includes $43.0 million for improvements to the roads which would be used to transport transuranic waste to WIPP.

The primary objective of WIPP is to demonstrate the technical and operational methods for permanent isolation of defense transuranic waste. The facility is designed to receive, inspect, emplace, and store defense waste. It will have the capability of disposing of defense transuranic waste and the Department will evaluate the feasibility of conducting experiments with defense generated high-level waste.

The construction of permanent surface and underground facilities started in July 1983 and operationally critical facilities was completed in FY 1988. Transuranic waste is now being certified for compliance with the WIPP waste acceptance criteria and stored for eventual shipment to the WIPP beginning in October 1988. After a 5 year demonstration period, a decision will be made to leave or retrieve the transuranic waste.

In FY 1988, the preoperational activities such as environmental permitting, operational readiness reviews and final assembly of the first NRC certified Transuranic Waste Package Transporters (TRUPACTs) will be completed. The TRUPACT will be used to transport transuranic waste to WIPP. During FY 1989 transuranic waste will be emplaced in WIPP to begin the 5 year demonstration period.

Certain highways in New Mexico have been designated as transportation routes for waste destined for WIPP. In 1982, the state identified which of these roads required improvements. In 1987, the state identified the need for the construction of new roads in New Mexico, along the designated WIPP transportation routes, to provide relief routes away from frequently traveled existing highways and provide bypasses around congested urban areas. Specific new roads have been proposed by the New Mexico State Highway Department.

Support will continue for the State of New Mexico's Environmental Evaluation Group to assure that the concerns of the people of that State are addressed.

(Chart 27) Included on the critical path for initiation of hot operations of WIPP in October 1988 is legislation to permanently withdraw WIPP land from public use. The legislation, introduced by the New Mexico Congressional delegation, is expected to be passed by Congress prior to October 1988.

Hanford Waste Vitrification Plant (HWVP)

(Chart 28) The proposed HWVP will incorporate high-level waste in borosilicate glass for permanent disposal in a Federal geologic repository. It serves the same function and is based on the same process technology as the DWPF now under construction at the Savannah River Plant except that an existing facility (B-Plant) will be used to decontaminate salt and process it for disposal onsite. While some refinements and testing are needed, the basic technology for vitrification of Hanford's high-level waste is in hand, and facility design and construction can be undertaken with confidence.

The broad scope of the Hanford Defense Waste EIS includes NEPA documentation for the HWVP. The record of decision, based on the EIS, will provide the basis for vitrification of high-level waste, onsite disposal of decontaminated salt immobilized in concrete, and disposal of previously separated and encapsulated cesium and strontium. The EIS was published in December 1987. Any additional NEPA documentation determined to be needed will be issued prior to the start of construction scheduled for late FY 1990.

The conceptual design was completed in the first quarter of FY 1988. Title I design will continue in FY 1989 as will support activities in the areas of technology development and demonstration for feed preparation, glass formulation, and equipment and systems testing; technology transfer from the DWPF and WIPP projects; and participation in the National program to qualify vitrification waste forms for disposal in a Federal repository.

Technical exchanges will continue with the PAMELA project in the Federal Republic of Germany, which has an operating high level waste vitrification melter.

The current plan is to begin construction in FY 1990 and commence hot startup in FY 1998. The current total estimated cost for the HWVP is $920.0 million.

WASTE RESEARCH AND DEVELOPMENT

(Chart 29) The Waste Research and Development program addresses the long-term management of defense radioactive wastes. The program consists of developing technologies for each waste type and assessing the associated hazards, costs, and environmental impacts of selection and implementation of long-term disposition alternatives. We are requesting $62.1 million for this important effort in FY 1989.

High-Level Waste Technology

We are developing technology that supports the long-term management of defense high-level waste at DOE sites. Our first emphasis is to support the DWPF at the Savannah River Plant, with the outyear emphasis shifting to the HWVP at Richland. The focus in FY 1989 is on waste form qualification for acceptance at a Federal geologic repository, including continuation of large-scale leaching tests and in-situ tests of simulated high-level waste in the WIPP. At the INEL, the feasibility of volume reduction process concepts for the calcined Idaho high-level waste is being evaluated.

During FY 1989, technical support for waste acceptance will include the development of the DWPF Waste Qualification Report which provides the data to show compliance with the Waste Acceptance Preliminary Specifications.

Transuranic Waste Technology

The basic purposes of the Transuranic Waste Technology program are to develop technology for management of buried TRU waste and to reduce generations of future waste. During FY 1989, the program will: continue buried waste immobilization studies at arid and humid sites; continue research and development activities for reducing the generation of transuranic waste in the future; initiate development of equipment for in-situ assay of buried waste and contaminated soil; and develop technology for safely exhuming buried waste and contaminated soil.

Low-Level Waste Technology

The Low-Level Waste Technology program supports DOE waste operations for the disposal of low-level solid wastes. This program will assist disposal operations in meeting the DOE orders by increasing assurance and developing guidance for a systematic low-level waste management program. The objectives of this generic applied technology program are to: improve techniques for disposal by shallow-land burial; provide supporting documentation in assuring compliance with DOE criteria for disposal; develop cost-effective treatment processes to stabilize certain low-level waste streams; reduce volumes by generation avoidance; and evaluate disposal concepts such as greater confinement for application at DOE sites.

FY 1989 activities will include providing accelerated leach test methodology for low-level waste forms; assisting in application of waste management system assessment methodology; providing criteria for radionuclide quantification; and environmental monitoring for disposal sites.

WIPP Research and Development

The mission of WIPP is to provide a research and development facility to demonstrate the safe disposal of defense waste. To implement this, the research and development program includes: site characterizations and evaluations; impacts of heat from radioactive wastes on the salt formation; plugging and sealing waste storage areas; performance of waste packages emplaced in salt; and evaluation of compliance with 40 CFR 191. The FY 1989 program will consist of completing the hydrologic model documentation, completing brine migration studies; initiating gas generation studies; evaluating seal design; geomechanical monitoring of the first storage panel during waste emplacement; and continuing performance assessment studies, including intrusion scenario development.

Hazardous Waste Research and Development

In FY 1989, the Hazardous Waste Research and Development program will develop field demonstration programs for treatment of reactive metals, cleanup and reclamation of waste acids, reduction in waste generation, and monitoring and detection of hazardous organic wastes using in-situ techniques.

HAZARDOUS WASTE COMPLIANCE TECHNOLOGY PROGRAM

(Chart 30) The Hazardous Waste Compliance Technology Program is requesting $9.8 million in FY 1989. This program provides support to Defense Programs (DP) in meeting operational Resource Conservation and Recovery Act (RCRA) requirements in the treatment, storage and disposal of hazardous and mixed hazardous and radioactive wastes. A significant part of the effort is technology transfer, for which the program manages a computer based system called the Waste Information Network. This system incorporates hazardous and mixed waste data bases, data analysis and reports relevant to DP facility RCRA compliance needs, and it contains access and communication capabilities between and among the waste management sites to assist them in meeting the terms of compliance agreements and consent orders.

In FY 1989, demonstration of cost-effective technologies for hazardous and mixed waste compliance will continue at DP sites. These demonstrations are designed for application to specific DP waste streams to reduce the volume of hazardous waste requiring disposal and to detoxify the waste or reduce the potential for migration to the environment, as required by RCRA.

In addition, technical support to DP sites is provided to help assure compliance with hazardous waste requirements. In FY 1989, the program's waste reduction activities will be in operation, including hazardous and mixed waste training, process and waste generation technology development, and technology transfer. Additional technology support to sites for hazardous and mixed waste compliance as a result of the Department of Energy byproduct rulemaking will also be provided.

Through the Hazardous Waste Compliance Technology Program, a coordinated effort to help assure compliance of DP production, processing and waste management facilities is provided.

TRANSPORTATION MANAGEMENT

(Chart 31) The Transportation Management Program request of $10.2 million is needed to ensure the continued safe, secure, and efficient movement of radioactive hazardous, and other materials and property to meet Department-wide needs. This includes the development and engineering of packaging certifiable by DOE and/or the Nuclear Regulatory Commission; the investigation of concepts and technologies for future packaging and transportation systems; the maintenance and advancement of capabilities to carry out such investigations; the establishment, implementation, and enforcement of operational policies and procedures relating to the transportation of the Department's property and materials; and informational activities to explain the DOE's transportation program and to address institutional issues and concerns. A corollary mission includes support for the Office of Civilian Radioactive Waste Management in related areas covered by the Nuclear Waste Policy Act. The program provides transportation and traffic management support to all DOE nonclassified programs. It assures that shipment of materials, and especially radioactive materials, is made in full compliance with Federal, State, local, and international transportation regulations.

REPOSITORY FEE

(Chart 32) In April 1985, the President supported DOE's recommendation to use the repositories to be constructed under the Nuclear Waste Policy Act of 1982, Public Law 97-425, for disposal of defense high-level waste. The Department is proceeding with arrangements to dispose of defense waste in the same repository to be used for civilian waste. On August 20, 1987, a final Federal Register Notice was published that established the method of calculating the appropriate fee to be paid by DOE into the Nuclear Waste Fund. No funding for the DOE repository fee has been paid into the fund to date, and none is included in the FY 1989 request. A Memorandum of Understanding between Defense Programs and the Office of Civilian Radioactive Waste Management is being prepared to determine the fee payment schedule.

SUMMARY

(Chart 33) In summary, the DWER budget does increase significantly. However, the base Interim Waste Operations funding remains level, and there is a slight increase requested for the Hazardous Waste and Remedial Actions program. The major increases in program reflect the transition from interim operations to terminal disposal with the approaching completion of the WIPP and DWPF projects, and the initiation of design of the HWVP at Richland. Finally, we are not requesting funding in FY 1989 for the repository fee.

This completes my presentation. I shall be happy to answer any questions you may have on either the Nuclear Materials Production program or the Defense Waste and Environmental Restoration program.

CHART 1

OFFICE OF NUCLEAR MATERIALS
FY 1989 CONGRESSIONAL BUDGET REQUEST
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
NUCLEAR MATERIALS PRODUCTION	$1,848.2	$1,808.7	$2,016.8
DEFENSE WASTE AND ENVIRONMENTAL RESTORATION	701.5	895.3	936.5
TOTAL	$2,549.7	$2,704.0	$2,953.3

CHART 2

NUCLEAR MATERIALS PRODUCTION
FY 1989 CONGRESSIONAL BUDGET REQUEST
PROGRAM GOALS

- MEET NUCLEAR WEAPONS STOCKPILE MEMORANDUM (NWSM) AND OTHER NEAR-TERM OPERATIONAL REQUIREMENTS
- MAINTAIN BASIC PRODUCTION CAPABILITY AND CAPACITY
- CONTINUE TO OPERATE NUCLEAR MATERIALS PRODUCTION FACILITIES IN A SAFE, SECURE AND ENVIRONMENTALLY ACCEPTABLE MANNER

CHART 3

NUCLEAR MATERIALS PRODUCTION
FY 1989 CONGRESSIONAL BUDGET REQUEST
N REACTOR

- REACTOR HAS BEEN IN A STAND DOWN CONDITION SINCE JANUARY 1987 AND WAS SCHEDULED TO RESTART IN MARCH 1988
- REVISED FORCE STRUCTURE PROJECTIONS INDICATE NEED FOR PLUTONIUM IS SIGNIFICANTLY REDUCED
- REDUCED REQUIREMENT CAN BE MET BY SR PRODUCTION REACTORS AND THROUGH RECOVERY OF PLUTONIUM RESIDUES
- PLACING N REACTOR IN COLD STANDBY APPEARS TO BE MOST PRUDENT ACTION IN RESPONSE TO THIS REDUCTION IN MATERIALS REQUIREMENTS AND BUDGET CONSTRAINTS

CHART 4

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CHART 5

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CHART 6

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CHART 7

NUCLEAR MATERIALS PRODUCTION
FY 1989 CONGRESSIONAL BUDGET REQUEST
NATIONAL ACADEMY OF SCIENCES REPORT ON
DOE PRODUCTION REACTORS

- PUBLISHED OCTOBER 1987
- 17 TECHNICAL RECOMMENDATIONS
  - DOE TAKING ACTION ON ALL RECOMMDENDATIONS
  - SPECIFIC IMPLEMENTATION PLAN UNDER REVIEW
- 4 SAFETY FRAMEWORK/3 SAFETY MANAGEMENT RECOMMENDATIONS
  - POTENTIAL MAJOR LONG-TERM OPERATIONS AND RESOURCE IMPACTS
  - EH ROLE EXPANDED, STRENGTHENED, AND MORE AUTONOMOUS
  - OUTSIDE INDEPENDENT OVERSIGHT TO THE SECRETARY
  - CONTRACTOR/LINE MANAGEMENT: EXPANDED AND STRONG TECHNICAL AND MANAGEMENT CAPABILITY

CHART 8

NUCLEAR MATERIALS PRODUCTION
FY 1989 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
OPERATING EXPENSES			
REACTOR OPERATIONS	$ 572.7	$ 550.0	$ 604.0
PROCESSING OF NUCLEAR MATERIALS	453.1	475.7	511.7
SUPPORTING SERVICES	223.1	221.8	259.7
URANIUM ENRICHING	176.7	153.0	169.0
PROGRAM DIRECTION	22.5	24.0	28.4
TOTAL OPERATING	1,448.1	1,424.5	1,572.8
CAPITAL EQUIPMENT	104.3	91.3	102.5
CONSTRUCTION	295.8	292.9	341.5
TOTAL	$1,848.2	$1,808.7	$2,016.8

CHART 9

NUCLEAR MATERIALS PRODUCTION
FY 1989 CONGRESSIONAL BUDGET REQUEST
CHANGES FROM FY 1988 APPROPRIATION
($ IN MILLIONS)

FY 1988 APPROPRIATION		$1,808.7
o ESCALATION		+ 42.7
o CORE PROGRAM		
- BASE ACTIVITIES	- 46.2	
- RESTORATION AND PRODUCTIVITY RETENTION	+ 12.2	
- SPECIAL ISOTOPE SEPARATION	+ 3.5	- 30.5
o ENVIRONMENTAL, SAFETY, AND HEALTH		+ 125.6
o SAFEGUARDS AND SECURITY		+ 2.8
o NEW PRODUCTION REACTOR		+ 40.0
o NAVAL REACTOR PROGRAM SUPPORT		+ 27.5
TOTAL FY 1989 REQUEST		$2,016.8

CHART 10

NUCLEAR MATERIALS PRODUCTION
FY 1989 CONGRESSIONAL BUDGET REQUEST
MAJOR ACTIVITIES
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
CORE PROGRAM			
BASE ACTIVITIES	$1,139.7	$1,014.9	$ 997.7
RESTORATION AND RETENTION	48.4	65.8	78.0
SPECIAL ISOTOPE SEPARATION	73.9	95.8	101.4
TOTAL CORE PROGRAM	1,262.0	1,176.5	1,177.1
ENVIRONMENT, SAFETY, AND HEALTH	272.2	301.8	434.6
SAFEGUARDS AND SECURITY	151.6	168.9	176.1
NEW PRODUCTION REACTOR	0	20.0	60.0
NAVAL REACTOR SUPPORT	162.4	141.5	169.0
TOTAL	$1,848.2	$1,808.7	$2,016.8

CHART 11

NUCLEAR MATERIALS PRODUCTION
FY 1989 CONGRESSIONAL BUDGET REQUEST
BASE ACTIVITIES

o MAINTAIN BASIC PRODUCTION CAPACITY AND CAPABILITY THROUGH OPERATION OF:

- FEED PRODUCTION PLANTS AT FERNALD AND OAK RIDGE
- THREE SAVANNAH RIVER REACTORS
- PUREX PROCESSING PLANT AT RICHLAND, TWO PROCESSING CANYONS AT SAVANNAH RIVER, AND PROCESSING PLANT AT IDAHO
- SCRAP RECOVERY FACILITIES AT ALBUQUERQUE, OAK RIDGE, RICHLAND, SAN FRANCISCO, AND SAVANNAH RIVER
- SUPPORT FACILITIES AT IDAHO, OAK RIDGE, RICHLAND, AND SAVANNAH RIVER
- TECHNOLOGY DEVELOPMENT ACTIVITIES AT VARIOUS LOCATIONS

CHART 12

NUCLEAR MATERIALS PRODUCTION
FY 1989 CONGRESSIONAL BUDGET REQUEST
RESTORATION AND RETENTION
($ IN MILLIONS)

	TEC	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
FACILITY RESTORATION (82-D-124)	$ 364.7	$ 3.9	$ 10.6	$ 5.9
PRODUCTIVITY RETENTION (86-D-149)	410.4	44.5	55.2	72.1
TOTAL		$ 48.4	$ 65.8	$ 78.0

FACILITY RESTORATION

o COMPLETES UPGRADE OF FACILITIES TO MAINTAIN THE PRODUCTION OF NUCLEAR MATERIALS IN SUPPORT OF NATIONAL DEFENSE PROGRAMS.

PRODUCTIVITY RETENTION

o PROVIDES FOR MODERNIZATION AND UPGRADE OF EXISTING PRODUCTION FACILITIES TO INCREASE OPERATING AVAILABILITY AND/OR EFFICIENCY OF CRITICAL PRODUCTION COMPONENTS.

CHART 13

NUCLEAR MATERIALS PRODUCTION
FY 1989 CONGRESSIONAL BUDGET REQUEST
SPECIAL ISOTOPE SEPARATION
(IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
OPERATING EXPENSES	$ 48.3	$ 70.0	$ 72.3
CAPITAL EQUIPMENT	1.0	0.8	0.5
CONSTRUCTION (TEC $550M)	24.6	25.0	28.0
GPP	0	0	0.6
TOTAL	$ 73.9	$ 95.8	$ 101.4

- FY 1988 TO FY 1990-MAJOR DEFINITIVE DESIGN EFFORT
- FY 1988-DEFINE DESIGN BASIS FOR PROCESS AND FACILITIES
- FY 1988-SITE PREPARATION FOR CONSTRUCTION FOLLOWING EIS RECORD OF DECISION
- FY 1989-START CONSTRUCTION AND PROCUREMENTS FOLLOWING INTEGRATED VERIFICATION DEVELOPMENT DEMONSTRATIONS
- FACILITY CONSTRUCTION WILL NOT BEGIN UNTIL COMPLETION OF KEY DEVELOPMENT ACTIVITIES

CHART 14

NUCLEAR MATERIALS PRODUCTON
FY 1989 CONGRESSIONAL BUDGET REQUEST
ENVIRONMENT, SAFETY, AND HEALTH
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
OPERATING EXPENSES	$ 197.9	$ 207.1	$ 324.1
EQUIPMENT	21.6	22.4	34.2
CONSTRUCTION	52.7	72.3	76.3
TOTAL ES&H	$ 272.2	$ 301.8	$ 434.6

- SIGNIFICANT INCREASES ARE REQUIRED TO IMPLEMENT NAS/NAE TECHNICAL RECOMMENDATIONS

- INCLUDES INITIATION OF NEW AND ACCELERATION OF ONGOING REACTOR SAFETY PROGRAMS TO ENSURE SAFE OPERATION OF PRODUCTION REACTORS

- INCLUDES INCREASES FOR REGULATORY COMPLIANCE ACTIVITIES AT ALL SITES

CHART 15

NUCLEAR MATERIALS PRODUCTION
FY 1989 CONGRESSIONAL BUDGET REQUEST
SAFEGUARDS AND SECURITY
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
OPERATING EXPENSES	$ 116.0	$ 127.8	$ 126.2
EQUIPMENT	12.4	11.1	7.9
CONSTRUCTION			
GENERAL PLANT PROJECTS	2.6	4.4	6.6
84-D-134 SAFEGUARDS AND SECURITY IMPROVEMENTS, SR	11.5	9.7	11.6
84-D-137 FACILITY SECURITY SYSTEM UPGRADE, ID	0.3	0	0
86-D-156 PLANTWIDE SAFEGUARDS SYSTEMS, SR	8.8	13.0	12.8
88-D-153 ADDITIONAL REACTOR SAFEGUARDS, SR	0	2.9	5.7
89-D-140 ADDITIONAL SEPARATION SAFEGUARDS	0	0	5.3
SUBTOTAL CONSTRUCTION	23.2	30.0	42.0
TOTAL S&S	$ 151.6	$ 168.9	$ 176.1

CHART 16

NUCLEAR MATERIALS PRODUCTION
FY 1989 CONGRESSIONAL BUDGET REQUEST
NEW PRODUCTION REACTOR
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
OPERATING EXPENSES	$ 0	$ 10.0	$ 25.0
88-D-154 DESIGN ONLY	0	10.0	35.0
TOTAL NPR	$ 0	$ 20.0	$ 60.0

O REACTOR NEEDED TO ASSURE CONTINUED TRITIUM PRODUCTION CAPABILITY

O PROJECT COST, SCHEDULE AND FUTURE FUNDING WILL BE DECIDED AFTER SELECTION OF PREFERRED REACTOR CONCEPT AND SITE

O ERAB CONVENED TO STUDY POTENTIAL REACTOR TECHNOLOGIES, RESULTS EXPECTED JULY 1988

CHART 17

NUCLEAR MATERIALS PRODUCTION
FY 1989 CONGRESSIONAL BUDGET REQUEST
NAVAL REACTOR SUPPORT
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
NAVAL REACTOR PROGRAM SUPPORT	$ 162.4	$ 141.5	$ 169.0

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CHART 18

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION
FY 1989 CONGRESSIONAL BUDGET REQUEST

PROGRAM GOALS

- SUPPORT NUCLEAR MATERIALS PRODUCTION REQUIREMENTS
- MAINTAIN BASIC CAPABILITY AND CAPACITY
- CONTINUE IMPLEMENTATION OF DEFENSE WASTE MANAGEMENT PLAN
- SUPPORT ENVIRONMENTAL RESTORATION ACTIVITIES AT ALL DP FACILITIES

CHART 19

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION

RADIOACTIVE WASTE TYPES

HIGH-LEVEL WASTE:	WASTE FROM REPROCESSING CHARACTERIZED BY HIGH HEAT AND LONG LASTING HAZARD
TRANSURANIC WASTE:	LOW-LEVEL WASTE CONTAMINATED WITH CERTAIN LONG-LIVED ALPHA ACTIVITY IN EXCESS OF 100 nCi/g.
LOW-LEVEL WASTE:	OTHER WASTE CONTAMINATED WITH SHORT-LIVED RADIOACTIVITY. INCLUDES CONTAMINATED EQUIPMENT, COMPONENTS, CLOTHING, TRASH, SLUDGES, ETC.

CHART 20

DEFENSE PROGRAMS-NUCLEAR MATERIALS

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT

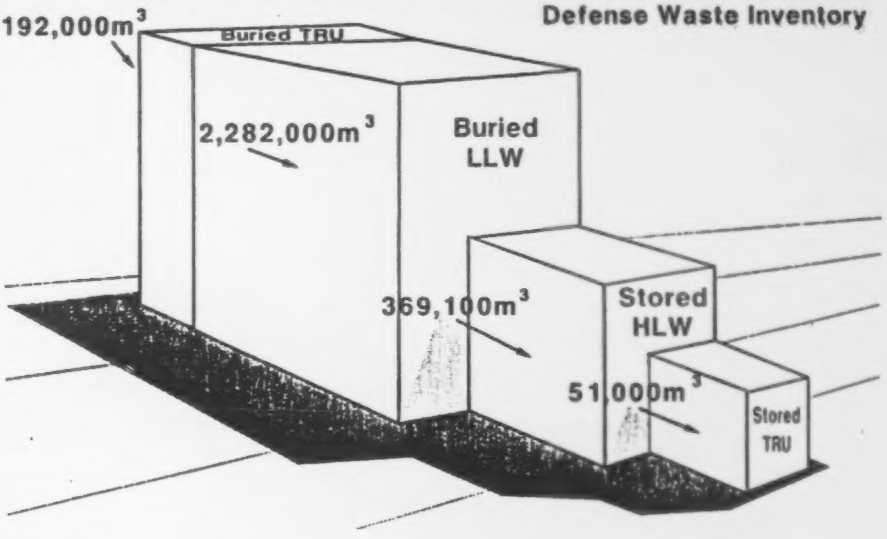

CHART 21

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION FY 1989 CONGRESSIONAL BUDGET REQUEST LEAD TABLE ($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
OPERATING EXPENSES			
ENVIRONMENTAL RESTORATION	$ 53.8	$ 97.8	$ 120.9
WASTE OPERATIONS AND PROJECTS	319.8	411.6	532.0
WASTE RESEARCH AND DEVELOPMENT	68.1	51.1	58.5
HAZARDOUS WASTE COMPLIANCE TECHNOLOGY	7.6	7.1	8.4
TRANSPORTATION MANAGEMENT	8.5	8.4	9.7
PROGRAM DIRECTION	2.1	2.5	3.1
TOTAL OPERATING EXPENSES	459.9	578.5	732.6
CAPITAL EQUIPMENT	38.3	43.7	52.7
CONSTRUCTION	203.3	273.1	194.2
SUBTOTAL	$ 701.5	$ 895.3	$ 979.5
USE OF PRIOR YEAR BALANCES	0	0	-43.0
TOTAL	$ 701.5	$ 895.3	$ 936.5

CHART 22

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION
FY 1989 CONGRESSIONAL BUDGET REQUEST
CHANGES FROM FY 1988 APPROPRIATION
($ IN MILLIONS)

FY 1988 APPROPRIATION		$895.3
o ESCALATION		+ 24.4
o ENVIRONMENTAL RESTORATION		+ 19.4
o WASTE OPERATIONS AND PROJECTS		
- DEFENSE WASTE PROCESSING FACILITY	$- 10.5	
- WASTE ISOLATION PILOT PLANT	+ 25.6	
- HANFORD WASTE VITRIFICATION PLANT	+ 18.5	
- OTHER OPERATIONS AND PROJECTS	- 2.9	+ 30.7
o WASTE RESEARCH AND DEVELOPMENT		+ 7.7
o HAZARDOUS WASTE COMPLIANCE TECHNOLOGY		+ 0.5
o TRANSPORTATION MANAGEMENT		+ 1.0
o PROGRAM DIRECTION		+ 0.5
SUBTOTAL		$979.5
PRIOR YEAR BALANCES		-43.0
TOTAL		$936.5

CHART 23

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION
FY 1989 CONGRESSIONAL BUDGET REQUEST
MAJOR ACTIVITIES
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
ENVIRONMENTAL RESTORATION	$ 53.8	$ 97.8	$ 120.9
WASTE OPERATIONS AND PROJECTS			
DWPF	186.6	217.0	210.2
WIPP	23.4	85.7	113.1
HWVP	0	7.5	26.0
ALL OTHER	349.1	414.5	424.1
	$ 559.1	$ 724.7	$ 773.4
WASTE RESEARCH AND DEVELOPMENT	69.7	52.4	62.1
HAZARDOUS WASTE COMPLIANCE	7.8	9.0	9.8
TRANSPORTATION MANAGEMENT	9.0	8.9	10.2
PROGRAM DIRECTION	2.1	2.5	3.1
SUBTOTAL	$ 701.5	$ 895.3	$ 979.5
USE OF PRIOR YEAR BALANCES	0	0	-43.0
TOTAL	$ 701.5	$ 895.3	$ 936.5

CHART 24

ENVIRONMENTAL RESTORATION
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988-APPROP.	FY 1989 REQUEST
REMEDIAL ACTIONS	$ 37.7	$ 80.9	$ 104.2
DECONTAMINATION AND DECOMMISSIONING	16.1	16.9	16.7
TOTAL	53.8	97.8	120.9

- o CONTINUE WASTE SITE CHARACTERIZATION STUDIES AS DIRECTED BY CONSENT ORDERS AND COMPLIANCE AGREEMENTS AT HIGHEST PRIORITY DP SITES
- o INITIATE REMEDIAL ACTION DESIGN FEASIBILITY STUDIES AS DIRECTED BY CONSENT ORDERS AND COMPLIANCE AGREEMENTS AT PRIORITY DP SITES
- o INITIATE SITE REMEDIATION ACTIVITIES AND INTERIM MITIGATIVE MEASURES IN ACCORDANCE WITH APPROVED PLANS UNDER REGULATORY ORDERS AND COMPLIANCE AGREEMENTS AT DP SITES
- o COMPLETE HIGHEST PRIORITY DEFENSE D&D EFFORTS

CHART 25

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION
FY 1989 CONGRESSIONAL BUDGET REQUEST
DEFENSE WASTE PROCESSING FACILITY
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
WASTE OPERATIONS AND PROJECTS	$ 186.6	$ 217.0	$ 210.2
WASTE RESEARCH AND DEVELOPMENT	7.4	2.8	3.8
	$ 194.0	$ 219.8	$ 214.0

- o CONTINUATION OF PREOPERATIONAL ACTIVITIES INCLUDING OPERATIONAL READINESS REVIEWS, LEADING TO OPERATIONS IN FY 1990
- o CONTINUE OPERATION OF SALTSTONE PLANT
- o PROVIDE OPERATIONAL AND LABORATORY SUPPORT
- o CONTINUE OPERABILITY TESTING TO CONFIRM DESIGN CRITERIA
- o BEGIN OPERATION OF 1/10 SCALE DWPF MELTER AND OFF-GAS SYSTEM TO CONDUCT INTEGRATED PROCESSING AND SYSTEMS TESTING DEMONSTRATION

CHART 26

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION
FY 1989 CONGRESSIONAL BUDGET REQUEST
WASTE ISOLATION PILOT PLANT (WIPP)
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
WASTE OPERATIONS AND PROJECTS	$ 23.4	$ 85.7	$ 113.1
WASTE RESEARCH AND DEVELOPMENT	16.1	20.9	19.2
	$ 39.5	$ 106.6	$ 132.3

- o RECEIVE AND EMPLACE WASTE
- o CONTINUE RESEARCH AND DEVELOPMENT PROGRAM
- o CONTINUE PERFORMANCE ASSESSMENT ACTIVITIES
- o IMPROVE WIPP ROADS

CHART 27

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION
FY 1989 CONGRESSIONAL BUDGET REQUEST
WIPP LEGISLATIVE LAND WITHDRAWAL

- o CRITICAL PATH FOR HOT OPERATIONS - OCTOBER 1988
- o LAND WITHDRAWAL BILL INTRODUCED BY NEW MEXICO CONGRESSIONAL DELEGATION
  - SENATE HEARINGS OCTOBER 1987
  - HOUSE HEARINGS DECEMBER 1987
- o LEGISLATION MAY BE HELD UP UNTIL THE FOLLOWING ISSUES ARE RESOLVED:
  - BRINE INFLOW (NAS EVALUATION TO BE SUBMITTED TO CONGRESS BY MARCH 1, 1988)
  - NEW MEXICO REQUEST FOR ROAD FUNDS
  - MINERAL LEASES

CHART 28

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION
FY 1989 CONGRESSIONAL BUDGET REQUEST
HANFORD WASTE VITRIFICATION PLANT
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
WASTE OPERATIONS AND PROJECTS	$ 0	$ 7.5	$ 26.0
WASTE RESEARCH AND DEVELOPMENT	14.8	6.9	7.4
TOTAL	$ 14.8	$ 14.4	$ 33.4

- o CONTINUE TITLE I ENGINEERING AND DESIGN
- o CONTINUE PROCESS DEVELOPMENT AND ENGINEERING SUPPORT
- o HOT OPERATIONS SCHEDULED FOR FY 1999

CHART 29

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION
FY 1989 CONGRESSIONAL BUDGET REQUEST
WASTE RESEARCH AND DEVELOPMENT
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
OPERATING EXPENSES	$ 68.1	$ 51.1	$ 58.5
CAPITAL EQUIPMENT	1.6	1.3	3.1
CONSTRUCTION (INCLUDING GPP)	0.0	0.0	0.5
	$ 69.7	$ 52.4	$ 62.1

- o DWPF SUPPORT FOR FY 1990 HOT OPERATION
- o HWVP R&D, DESIGN, AND SUPPORT
- o TERMINAL STORAGE R&D AND DEMONSTRATION
- o TECHNICAL SUPPORT FOR HIGH-LEVEL, LOW-LEVEL, TRANSURANIC AND CHEMICAL WASTES

CHART 30

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION
FY 1989 CONGRESSIONAL BUDGET REQUEST
HAZARDOUS WASTE COMPLIANCE TECHNOLOGY
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
COMPLIANCE TECHNOLOGY	$ 3.3	$ 1.6	$ 3.5
INFORMATION SYSTEMS	2.4	1.2	1.3
DEMONSTRATIONS	1.9	4.3	3.6
CAPITAL EQUIPMENT	0.2	1.8	1.4
GPP	0	0.1	0
TOTAL	$ 7.8	$ 9.0	$ 9.8

o DEMONSTRATE COST-EFFECTIVE HAZARDOUS WASTE AND MIXED WASTE TREATMENT, STORAGE AND DISPOSAL TECHNOLOGIES TO ASSIST DP ACTIVITIES IN COMPLYING WITH RCRA REQUIREMENTS

o BEGIN OPERATION OF DP-WIDE HAZARDOUS AND MIXED WASTE REDUCTION PROGRAM

o CONDUCT TECHNICAL ASSISTANCE AND TECHNOLOGY TRANSFER ACTIVITIES, INCLUDING OPERATION OF THE WASTE INFORMATION NETWORK TO SUPPORT DP HAZARDOUS AND MIXED WASTE COMPLIANCE ACTIVITIES

CHART 31

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION
FY 1989 CONGRESSIONAL BUDGET REQUEST
TRANSPORTATION MANAGEMENT
($ IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROP.	FY 1989 REQUEST
OPERATING EXPENSES	$ 8.5	$ 8.4	$ 9.7
CAPITAL EQUIPMENT	0.5	0.5	0.5
	$ 9.0	$ 8.9	$ 10.2

o DEVELOP AND TEST PACKAGES FOR RADIOACTIVE AND HAZARDOUS MATERIALS
- STANDARDS, MATERIALS, ANALYTIC TECHNOLOGY
- MODELING TECHNIQUES, SYSTEM EVALUATIONS, AND TESTS
- SAFETY AND RISK ASSESSMENTS, TRANSPORTATION NETWORKS, LOGISTICS, AND ECONOMICS

o PROVIDE CENTRALIZED EXPERTISE AND MANAGEMENT OF DOE-WIDE TRANSPORTATION AND PACKAGING ACTIVITIES
- TRANSPORTATION/PACKAGING OPERATIONS
- TRAINING
- INFORMATION PRODUCTS
- DATA SYSTEMS
- SATELLITE TRACKING SYSTEM (TRANSCOM)

CHART 32

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION
FY 1989 CONGRESSIONAL BUDGET REQUEST
REPOSITORY FEE FOR DISPOSAL OF DEFENSE HIGH-LEVEL WASTE

- THE PRESIDENTIAL DECISION WAS ANNOUNCED IN APRIL 1985 ON USE OF A CIVILIAN WASTE REPOSITORY FOR DISPOSAL OF DEFENSE HLW
- FEDERAL REGISTER NOTICE PUBLISHED 8/20/87 ON METHOD FOR CALCULATING FEE
- PAYMENT SCHEDULE WILL BE BASED ON AGREEMENT BETWEEN DP AND THE OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
- NO FEE REQUEST INCLUDED IN FY 1989 CONGRESSIONAL BUDGET

CHART 33

DEFENSE WASTE AND ENVIRONMENTAL RESTORATION
FY 1989 CONGRESSIONAL BUDGET REQUEST

SUMMARY OF FY 1989 REQUEST

- DWTM BUDGET INCREASES BY 5%
- WASTE OPERATIONS REMAINS LEVEL
- MAJOR INCREASES REFLECT TRANSITION FROM INTERIM OPERATIONS TO PERMANENT DISPOSAL
    - DEFENSE WASTE PROCESSING FACILITY
    - WASTE ISOLATION PILOT PLANT
    - HANFORD WASTE VITRIFICATION PLANT
    - MIXED WASTE RULEMAKING
- INCREASE REQUESTED FOR ENVIRONMENTAL RESTORATION (24%)
- WASTE FEE IS NOT INCLUDED IN FY 1989 REQUEST

NEW PRODUCTION REACTOR

Senator JOHNSTON. I thank you, gentlemen, for very informative testimony.

I have a goodly number of questions here and I would like to cover them very briefly. And I would rather have half an answer if we can do that briefly, than get the full answer and not be able to get to the other matters. And maybe if they are only half answers, we can get the full answer in writing for the record. But I have a lot of curiosity about a number of these things.

And let me just throw this out to either one of you who would like to answer.

First, with respect to the new production reactors. Senator McClure, and I, and others have an interest in HTGR or other kind of more inherently safe reactors. One of the ways to get that technology on line—we have an interest, not only as in the production reactor mode, but for the civilian mode—and to do it as a production reactor would be a good way to get the technology demonstrated.

Am I correct, though, that the need for the production reactor is too immediate to go with an HTGR type for the first reactor? Would that have to be a second reactor, or is that subject to opinion?

Mr. WADE. I don't think we have precluded any technology, Mr. Chairman. The mechanism that is currently in place within the Department has the Energy Research Advisory Board, a special panel that they have created with a large number of experts, looking at all four candidate technologies: light water, heavy water, the HTGR, and liquid metal.

They are weighing those technologies against criteria established by the Department for the new production reactor.

They will, in late June, present to the Secretary their findings, and Secretary Herrington will make a choice in July of a reference technology and a reference site, which would then allow the Department to proceed with the environmental work.

It is a true statement, sir, that at this point in time I would have to say all technologies have an equal chance.

Senator JOHNSTON. Well, I wish you would convey at least my strong feelings that to the extent that the building of this first reactor could aid in the development of a more inherent safe reactor for use for the generation of electricity, and that this technology should be an important consideration. Defense, of course, is first, but if you can do it I think that is very important, because I see we are going to need energy, and light water reactors are in disrepute. I think undeservedly so to a large extent. But that is still a fact that they are.

HANFORD CLEANUP

Now, I really did not realize we had the N Reactor in cold standby. I think, frankly, that is a big waste. We are not going to start that reactor again.

I would personally like, to the extent we have that kind of money—and I think it is principally a question of jobs; and I have a lot of sympathy for workers who lose their jobs—but I would like to put that money on cleanup at Hanford.

Do we have any idea what the cost of cleanup at Hanford is?

Mr. WADE. We do not have a good figure for you, sir, on what the total cost of the ultimate cleanup of Hanford would be. I would like to make two comments, if I might. I think that until we have the SIS plant operating, and we are well underway with construction for the new production reactor, it is a prudent thing to have the ability to restart N Reactor.

Senator JOHNSTON. Well, I think that prudency has been discovered only since my friends from Washington came in and pointed out the economic stress of losing all those jobs.

N REACTOR SHUTDOWN

Mr. WADE. I regret as much as you do the effect of putting N Reactor on full standby because that does reduce——

Senator JOHNSTON. What does it cost us?

Mr. WADE. It reduces the operating levels from about—Jill, help me.

Ms. LYTLE. Originally, the cost was going to be about $370 million, and now it is about $159 million. In our budget planning we originally had about $300 million.

Senator JOHNSTON. Well, to shut it down, that would be some shutdown cost, wouldn't it?

Ms. LYTLE. Are you talking about the difference between——

Mr. WADE. Difference between operating and cold standby.

Senator JOHNSTON. I am talking about the difference between cold standby and shutting it down.

Mr. WADE. Shutting it completely down?

Senator JOHNSTON. $159 million?

Ms. LYTLE. No, sir. Our estimate about a month ago was around $90 million over a 2-year period.

Senator JOHNSTON. Shutdown cost.

Ms. LYTLE. That would be the difference between a complete shutdown and the cold standby plan we have now going into effect.

Senator JOHNSTON. It is $90 million?

Ms. LYTLE. Yes, sir.

Mr. WADE. Over 2 years.

Ms. LYTLE. Over 2 years. That would be the difference.

Senator JOHNSTON. Well, now this cold standby is supposed to last for how long?

Mr. WADE. We have not set a time, Senator Johnston. The difference between cold standby and total shutdown is done in two stages. If it is on cold standby, we do have people still involved. We do maintain systems. If you shut it completely down, you then begin moving into a path that takes you to decontaminating and decommissioning.

Senator JOHNSTON. Which will have to be done anyway.

Mr. WADE. Which ultimately will have to be done, but something we do not believe we need to do immediately.

Senator JOHNSTON. Well, I mean, if you don't have to move to that step yet, then that is not a comparable cost.

Could you give us a comparable cost, including the safety improvements, so we know what we would save by a real shutdown?

Mr. WADE. We will provide you a detailed breakdown of that, Senator.

[The information follows:]

N REACTOR SHUTDOWN

If all work were stopped on the safety enhancement program as of April 1, 1988, and only work to put the reactor in a shutdown condition (never to be restarted) were done, approximately $40 to $45 million would be saved (in fiscal year 1988 and fiscal year 1989). These estimates are preliminary and may change based on a final determination of resource requirements for cold standby. An earlier estimate of saving $95 million for fiscal year 1988 and fiscal year 1989 was based on a shutdown decision being made on February 1, 1988.

In the 2 months that have passed, approximately $26 million of that potential savings have been spent on ongoing work in preparation for cold standby. In addition, the estimated cost of placing N Reactor in cold standby has been reduced in the last 2 months by approximately $25 to $30 million, thereby reducing the difference in cost between achieving cold standby versus shutdown.

Senator JOHNSTON. And I am not insensitive at all to the employment impact. What I would like to do, if we could, is to see where else we could use that money for jobs in the state of Washington without just wasting the money, as it looks like to me it is a waste.

WASTE ISOLATION PILOT PLANT

Quickly, what is the status of the brine seepage problem at the WIPP?

Mr. WADE. We have the National Academy of Sciences' report. We are in agreement with the National Academy. We met with them last——

Senator JOHNSTON. Any problem?

Mr. WADE. There is a problem in defining an experimental program that will satisfy the National Academy's——

Senator JOHNSTON. Where did the brine come from?

Mr. WADE. It is leached brine that is in the salt formation and has been there for years. And there is just more of it, if you will——

Senator JOHNSTON. It looks like air bubbles, only it is water bubbles.

Senator MCCLURE. You squeeze it out.

Mr. WADE. You squeeze it out.

Senator JOHNSTON. Oh, it is not dripping down through the pipe holes or anything?

Mr. WADE. No. It is clearly not the problem that was originally identified and got all the press play. We have agreed with the Academy, and we have talked with Senator Domenici and his staff on a plan to once and for all satisfy that issue. It means a reduction early on in the amount of waste that we would put in WIPP, but it is still our intent to open the facility later this year on schedule.

Senator JOHNSTON. Is it fair to say, in your opinion, it is not really a problem? It is simply another one of the hoops we are going to have to jump through.

Mr. WADE. That is my feeling exactly.

DOE/DOD RELATIONSHIP

Senator JOHNSTON. All right.

We will be submitting a letter; Senator Domenici is the author of it, and I strongly concur on this status between DOD and DOE. We strongly feel that the laboratories ought to be under DOE control, and we feel that DOD, by having a bigger budget—and we appreciate Secretary Carlucci putting up some money to run the laboratories, but it is taking over too much. You know, the control sort of follows the money. So take that statement to wherever it may land.

Dr. BARKER. Is that a statement of philosophy or have you got a fiscal mechanism on which to accomplish the objective?

Senator JOHNSTON. Well, it is a——

Senator MCCLURE. If you please, Mr. Chairman. We think that we reached a good compromise when we created the Coordinating Council that you have so diligently worked on and worked with. We are somewhat concerned about some of the requests of DOD to DOE that for long-term purposes they submit their budgets in detail to the Department of Defense. The letter says we thought that it was supposed to be going to the Council, and the Council is supposed to be the arbiter that is the face for both Departments. And that just says that we do not want it to go beyond the Council. That was the compromise. I think that is the expression of the letter.

START TREATY

Senator JOHNSTON. If we have a START treaty what would the reduced needs of the Department be?

Dr. BARKER. Any exercise that I have seen that looks at potential impacts of START on the stockpile really does not show an effect on our requirements on DOE until the post-1995 timeframe. So that the early part of the demand curve that you saw Mr. Wade present is fundamentally unchanged. They continue to look at various options as to what specific restructuring they would do in the advent of a START agreement. There is no definitive plan within Defense at the moment.

Senator JOHNSTON. All right.

Dr. BARKER. I am sorry I cannot be more specific on that.

INSENSITIVE HIGH EXPLOSIVES

Senator JOHNSTON. All right.

You say that we have less than [deleted] weapons as insensitive high explosives, but on airplanes, when you replace the SRAM II [deleted] all the air-delivered ordnance will have insensitive high explosive?

Dr. BARKER. By that time, certainly everything on alert aircraft will have insensitive high explosive. By the time SRAM II is fully deployed; yes.

Senator JOHNSTON. I mean, all your gravity arms and other things——

Dr. BARKER. Yes; the B–83 and the B–61 will replace all of the older bombs. Those two new bombs, the 61 MOD and the 83, have insensitive high explosive.

Senator JOHNSTON. So, in effect, you are going as fast as you can. You do not need any prodding from us to say that we replace everything on the airplane.

Dr. BARKER. Just to keep the program on schedule.

NUCLEAR WEAPONS TESTING

Senator JOHNSTON. All right; good.

In testing, if we could pick a time when we just completed a testing program, and had a testing treaty with the Soviet Union, what would be your answer to the argument that that would be a symetrical detriment to both sides on stopping testing at that given point in time?

Dr. BARKER. I would like to provide you with a lengthy answer on that for the record, Senator.

Senator JOHNSTON. Yes.

[The information follows:]

TESTING PROGRAM

It definitely would not be a symmetrical detriment to both sides. The United States and the Soviet Union are two different societies having different philosophies. We will cite several important asymmetries.

Soviet delivery systems generally have greater payload capacity and throw-weight than similar United States systems. This weight advantage, as well as a volume advantage, means the Soviets need not design at the edge of their technology. On the other hand, U.S. weapons development practice has been to try to optimize cost versus benefit which has been manifested in very carefully tailored warhead and delivery system combinations. Some very important elements included in this "benefit," as used here, are: weapon effectiveness, safety, security, and survivability. Such design practices necessitate application of more sophisticated technologies then if we were free to ignore cost versus benefit. This careful tailoring requires nuclear testing as an integral part of continued technological competence in nuclear weapons.

Nuclear testing is essential to avoid underestimation—or overestimation—of current and future Soviet capabilities. Since 1962, when both the United States and the Soviet Union ceased atmospheric testing, we have not been able to obtain much information about modern Soviet warhead designs. We do know that in terms of their capital investments in laboratories, production facilities, and in their active test program, their efforts devoted to nuclear weapons are very impressive. And, on occasion, when we have been able to gain insights into their nuclear weapon technology, we have been struck by some Soviet technical achievements. So when we hear assertions that a test ban somehow would lock the Soviets into a position of inferiority, we have good cause to be skeptical.

Without nuclear testing, the confidence in the reliability of stockpiled weapons will decrease. This is a fact. There is no reason, no evidence, or inference to argue that Soviet weapons—or Soviet confidence in the reliability of their weapons—would deteriorate at the same rate as the United States. In fact, their size and weight advantages argue that Soviet confidence in their stockpile would degrade less rapidly than our own.

An asymmetry in nuclear weapon technological competence between the United States and the Soviet Union could be yet another adverse consequence for any cessation in testing. Without data from nuclear tests, our scientists and engineers could not retain the expertise to maintain the stockpile. Without the challenge of nuclear tests, many would leave the weapons program. Soviet scientists and engineers could be forced to remain. In addition, there is the potential of maintaining a weapons technology expertise through a clandestine nuclear weapons testing program.

Finally, we must always remember that a ban on testing would not preclude non-nuclear modernization of nuclear forces. The Soviets could continue their extensive hardening of command and control facilities, and they could put more of their nuclear weapons into mobile units to increase the survivability of their strategic nuclear forces. Future Soviet advances in nonnuclear antisubmarine warfare technology could jeopardize the sea-based leg of our nuclear deterrent Triad. If we cannot test, we cannot develop the nuclear weapons necessary to maintain a credible deterrent.

As a consequence of these differences, any ban on nuclear testing will affect the security of the two societies in different ways. As the United States has historically relied on the edge of technology to accomplish its goals, American interest will be much more adversely impacted than those of the Soviet Union.

Dr. BARKER. I think the fact that we operate with two different societies means——

Senator JOHNSTON. I know we have discussed that before in terms of if you did not test you could not keep your people where they keep their people.

Dr. BARKER. Right; and that is the principal aspect. The other aspect is that we really do not know enough about Soviet weapons to know that there is—there is no reason to argue that their weapons would in any way deteriorate at the same rate that ours would. There is no reason to argue that they would not take different risks than we would in terms of modernizing systems even without testing.

Senator JOHNSTON. Gentlemen, we have a vote on. Did anybody want to ask questions before the vote or do you want to come back afterward?

Senator MCCLURE. Come back afterward.

WASTE ISOLATION PILOT PLANT

Senator DOMENICI. Mr. Chairman, might I say I cannot return. I have to go to a markup with Senator Chiles. Most of mine are unclassified, but I wanted to just tell the committee quickly in the presence of our two witnesses of your interest in WIPP. Senator McClure also is tremendously interested in it getting open. For the first time, the administration has requested, pursuant to the stipulated agreement with the state of New Mexico, $43 million in roadway improvement money. These roads must be improved to accommodate the trucks from around the country that will deliver dispense waste to WIPP. There is an agreement between the state and the federal government that has been in existence for years. The administration never requested funding for the road improvements. They did this year; they are within this budget; and you recommended how we ought to pay for them. Is that not correct?

Mr. WADE. That is correct. There is $43 million in the budget request.

Senator DOMENICI. All right. And I just wanted you all to know that it will be very difficult to open WIPP if we haven't given the Governor and others in that state a good faith effort to meet the terms of that stipulated agreement. There are some other questions, but I will submit them in an unclassified note to you.

NUCLEAR WEAPONS COMPLEX MODERNIZATION

Senator JOHNSTON. All right.

Gentlemen, I wonder if you would provide us in writing with a sort of a broad-brushed statement of what in the nuclear weapons complex needs to be replaced, and when, at what cost, and what the principal dangers are in continuing to operate these old facilities? We used the figure of $100 billion to replace it. I don't know whether that is valid or not and I do not know what the dangers are. I mean, we know about N Reactor; that has now been shut down. But I wonder with these others what the risks or dangers are. Is it only to national security? Is it to the public? And if you could do that, I mean I do not need a big volume, just sort of a broad-brush so we can get the generalities. And then if we need to go into it in more detail at another hearing, we can do that.

Mr. WADE. If I may, Senator, the report that we are required to submit in December will be precisely that. Between now and then perhaps we could give you an interim report about where we think we are going. It is going to take a little while to get the data all together for the report. We are working very hard on it at the moment.

Senator JOHNSTON. All right. If you could just get us two or three pages broad-brush in the meantime.

Mr. WADE. Sure; we certainly can do that.

Senator JOHNSTON. I know to really put in a budget request you have got to have everything just right. But it is sort of a Kentucky-windage testament of what it is going to cost to replace it. And mainly sort of the risks in the meantime, because N Reactor risks took certainly the public by surprise. Many of us on this committee have known about that for some time. There may be some other risks there that we don't know anything about.

When we return, Senator Sasser, can you preside?

Senator SASSER. Mr. Chairman, unfortunately, I cannot. As a matter of fact, I will not be returning after this vote.

Senator JOHNSTON. All right.

Well, if whoever is senior——

Senator HATFIELD. Whoever gets back first.

Senator JOHNSTON. That is right. Thank you very much, gentlemen.

[The information follows:]

MODERNIZATION OF NUCLEAR WEAPONS COMPLEX

The Department is currently in the process of preparing a summary estimate of what needs to be replaced within the nuclear weapons complex and the estimated cost of such replacement. This data is expected to be available by June 1, 1988, and will be provided to the comittee at that time.

[A brief recess was taken.]

Senator McCLURE [presiding]. There are a number of questions that I know various members will wish to submit for the record for response in writing, and according to their nature, they will be submitted in classified or unclassified form.

PLUTONIUM DEMANDS

Senator McCLURE. I wish in some respects that this were an open hearing. This is the first opportunity we have had in the Senate, perhaps, to set the record straight as to some comments made by the

Secretary recently with respect to plutonium, and it is unfortunate that we have to do it in closed session because the public needs to know. I am sure you have seen that.

Unfortunately, I sometimes am very critical of the newspapers for being very inaccurate, but, unfortunately, that headline is accurate [indicating]. And I defer to the committee record from the House in which Secretary Herrington, being questioned by Mr. Dicks about the N Reactor, and Secretary Herrington was responding that tritium was the problem. And Mr. Dicks was asking whether or not the N Reactor could be converted to tritium. And Secretary Herrington went further to say exactly what the headline says, "Plutonium, we're awash with plutonium. We have more plutonium than we need." And then he went on to talk about tritium.

Now, as you know, you are headed for Idaho and you are going to be involved with some public comments out there. And this happens to be out of a Seattle newspaper, not an Idaho newspaper. But I guarantee you I got this from an Idaho source, not from a Seattle source, and I think you know, and I know, some of the people who will have this in their hand when you are talking.

Tell me what is the truth. Are we awash in plutonium?

Mr. WADE. No, sir. The Secretary—I have no idea, Senator, how he conjured up the word "awash." We had briefed him in some detail on the changes in requirements coming from the budget summit, and the fact that what those changes meant was that in the near term we did not need the plutonium. Our plutonium requirement had gone down in the near term. That was the basis for the N Reactor decision, but it was a decision made knowing that it was not without risk. We agreed at the Nuclear Weapons Council and it was passed on to both Secretries that in not restarting N Reactor, and taking the actions we were taking, we were agreeing to take a bigger risk than we had in a good number of years.

Is that accurate, Bob?

Dr. BARKER. Yes. The requirement did change dramatically, Senator McClure, because of the fiscally driven decision to retire the Poseidon boats which earlier requirement plans had assumed would continue in operation. The decision to retire these boats was for fiscal reasons, we will be obtaining from the warheads abroad those boats about the [deleted].

So the DOE tells us that we can meet our Defense requirements without N Reactor if everything else works right. We went through with DOE what "everything else" was. That is the Savannah River reactors coming up at least to 70 percent, if not 90 percent, of full power. That is, the fact that SIS is going to be pursued and will be available in the latter part of the 1990's, should some unforeseen occurrence make the Savannah River reactors not available to us, and the fact that there will be an aggressive program to obtain material from scrap in fiscal year 1990 and beyond.

But my perception from my interaction with the Department of Energy is that every single one of those things has to work right in order for us to meet our requirements.

WEAPONS RETIREMENTS

Senator McClure. Did I understand your answer correctly to indicate that it is the recycling from the weapons abroad the Poseidons [deleted].

Dr. Barker. Yes; that is true.

Senator McClure. How much of the difference in materials requirement comes from the naval reactors' program?

Mr. Wade. None, sir.

Senator McClure. There is no change in that program?

Mr. Wade. None, sir.

Senator McClure. Or that level requirement because of the retirement of the Poseidon?

Mr. Wade. No, sir.

Senator McClure. What happens if Congress does not agree with the retirement of the Poseidons?

Dr. Barker. Then we are in trouble.

Senator McClure. It is a double-edged consequence then.

Dr. Barker. Yes.

Senator McClure. I know Admiral McKee will be before us and he will tell us why. And I think it is too bad that we cannot get it all wrapped together in one package, but we will have to take at least two bites.

I, for one, question the economic utility of abandoning weapons systems that are in existence that could be maintained in existence at far lower cost than the production of new ones.

[Deleted.]

Dr. Barker. Well, let's say that these boats are being retired at a point when there would have had to be a major overhaul——

Senator McClure. That is correct.

Dr. Barker [continuing]. And refueling. That is a one-time cost savings of about $100 million per boat to retire them, vice keep them in operation. And then there are the nuclear materials that are recovered from the warheads.

Senator McClure. Yes. And then we will spend far more than that to replace an equal amount of target kill capability.

Dr. Barker. But we are already paying for that, Senator. We will not lose missiles at sea. The retirement schedule of these boats has been phased in a way such that we will be approximately replacing their capability with Trident submarines.

Senator McClure. Yes.

Dr. Barker. So what we are denying ourselves is an ability to increase our capabilities at sea.

Senator McClure. That is correct. And the most survivable systems we have are the ones at sea.

Dr. BARKER. Yes. As Secretary Carlucci reminded us in his testimony, this budget is fraught with risks. But it is the most acceptable situation we could arrive at within the total budget number for the 050 account.

Senator McCLURE. Again, I am extremely skeptical of the idea of trading in survivable systems for ones that are more vulnerable at much higher costs. That, to me, does not compute.

Dr. BARKER. It is unclear to me, Senator, which less survivable systems we are trading.

Senator McCLURE. Where shall we start? Since I think everyone says that the ones at sea are the most survivable.

VALUE OF TRIAD

Dr. BARKER. This is a long and philosophical discussion. We depend upon the Triad because we think that each leg has specific advantages that enhance our deterrence. So we depend upon an air-based leg, we depend upon a land-based missile leg, we depend upon a sea-based missile leg. We want the Soviets to be threatened by that mix because it makes life much more difficult for them and it enhances the credibility of a deterrent.

We have done the best we can and we think we have achieved the best balance with that mix.

I think the Secretary of Defense would be delighted if there were more money available and we could have more capability in each one of those legs.

Senator McCLURE. I know we will not solve that here today and we do not really have time to. I wish we did. And I don't know how many share my conviction, but I think it is entirely possible that the Congress may not agree with the recycling of all that material that would otherwise be unavailable.

Let me indicate too—and I say this because I noticed Senator Johnston's questions with respect to cold standby—I support the cold standby decision for a variety of reasons, not the least of which is the one additional option in the event you run into some unexpected difficulties. And it is a risk reduction exercise that I think is justified. But I will welcome the cost analysis which you provide that will indicate how much we are paying for that.

But I am extremely concerned, as you know, with respect to the condition of our weapons production facilities. Savannah River is not as secure a potential as we would like to believe. We have seen the reductions. It was just a very few years ago we had four fully operating reactors there, and today we have less than one and a half. And every step has been negative.

Mr. WADE. Senator, we will try to answer Senator Johnston's questions, but I honestly did not quite understand where he wanted to take me. Most of the people involved at N Reactor are going to be laid off as we go to cold standby. A small percentage are left.

Also a fact of life is that the minute we say that we are shutting down that reactor, we immediately buy right into the decontaminating and decommissioning program and that is something we will have to face eventually. We are not trying to skirt the issue. It is just something we don't think we need to face now for several reasons.

Senator McClure. Well, certainly the most critical side of the production facilities is tritium, and N Reactor. There is no short-term answer to that question.

Mr. Wade. That's right.

PLUTONIUM PRODUCTION

Senator McClure. It has only the incremental capacity to assist in the event that plutonium production that goes on at Savannah River were lost. Other than that, it does not contribute much in the short term, to any solution to any of the short-term problems.

But that is not insignificant. We can say that's all there is. But that is fairly significant if, as a matter of fact, you run into further reductions and not just shut down at Savannah River.

But you know and I know that those reactors are old. And while we like to say that we have full confidence in their safety, we cannot express the same confidence, the same degree of confidence, about their ability to continue to operate and produce even at current levels, let alone increased levels.

I think that is fair, isn't it?

Mr. Wade. That's correct; yes, sir.

Senator McClure. And so there is no public safety involved in the decision to continue to operate them in the same sense that there is a great danger to our reliance on them for materials production. Now that is just an execrable fact of life. It is also one of the reasons, Mr. Wade, why I am so concerned that we not confine ourselves to a single reactor strategy with the reactor probably to be built at Savannah River. I say that because I recognize where the political support for the new production reactor is. If we build another reactor at Savannah River and have some kind of an accident that closes down the site, we have all of our eggs in the same basket even though one of them is a new egg.

And I cannot understand a Nation that would put itself at risk that way if there is an alternative that has a measureable but modest cost to the alternative.

Mr. Wade. As you may know, as a result of the conversations that you and I had a few weeks ago, we went back and transmitted to the ERAB the specific language that talked about duality. We have subsequently talked with them, and they will address that issue. The Secretary will have to take that into account when he makes his initial preferential selection.

Senator McClure. Well, I am not going to just tell Senator Thurmond, Senator Nunn, and Senator Hollings that I think we should not build a reactor at Savannah River. I know how far I would get talking to them about that. I have undertaken some hopeless battles before, but only ones that I thought were worth undertaking.

But absent that political fact of life, it would make no sense to build the first replacement reactor alongside the old ones and expose them to whatever site hazards there are. I think every study we have had said get some geographical diversity. That has been said for at least 10 years that I am aware of. And I strongly urge that we move in that direction because otherwise we perpetuate some of the major uncertainties and fears which we seek to cure by building a new reactor.

Mr. WADE. Well, I certainly agree with that. The thing we are going to need a lot of help with is framing an authorization and appropriation environment which will allow us to proceed with things like one or two new reactors, and SIS, and the other things we need to do.

We clearly are not going to be able to do it in a 2.7-percent Defense budget growth situation. We cannot accommodate the new facilities that we have to have.

Senator MCCLURE. I think that is true, because all of our production facilities in the weapons complex are aging, almost without exception, from the production of materials to the finished weapons themselves.

Mr. WADE. That's correct.

Senator MCCLURE. And we are not talking about a few billion dollars. We are talking about dealing with that entire complex.

ROCKY FLATS FACILITIES

I notice your budget proposal has in it some additional expenditures at Rocky Flats, and I think those expenditures are indicated. And yet, I know that Senator Wirth does not have in mind that it continue to operate very much longer.

Mr. WADE. Rocky Flats is a good example. There is an increment of money in this request for Building 371.

I think Senator Wirth and I have now come to an understanding that even if we made the decision today to move Rocky Flats, it would take 15 years and several billion dollars to do it. And we still, therefore, need to modify Building 371.

Senator MCCLURE. Well, I think that is the same thing that tells us we ought to build the SIS. That is no permanent solution to a problem, but it is the best available, most cost-efficient alternative for the mid-range future.

Mr. WADE. That's correct.

TRITIUM REQUIREMENTS

Senator MCCLURE. How much of the materials requirement revisions since the testimony last year is tritium? Has there been any revision in the tritium goals?

Mr. WADE. The only tritium change would be that associated with the INF. I thought as of today it is the INF and then the Poseidon.

Senator MCCLURE. And the Poseidon are phased in over the next several years.

Mr. WADE. But that is not a significant——

Senator MCCLURE. So there is no major change. Or I won't say it is not measureable, but it is not a large change in tritium requirements. Am I correct?

Mr. WADE. That's correct.

Senator MCCLURE. I was trying to read your expression.

Ms. LYTLE. Yes, Senator; I always like to have the details.

Senator MCCLURE. Yes, I understand. I am not trying to pin you down. I just want to understand, because we went through an awful lot of trouble last year to get stockpile requirements pinned down. And both in this committee and in the authorizing committee, and suddenly in the space of months they are being changed dramatically. And I think every one of us is not only asking but being asked, What's the change?

Dr. BARKER. Senator, with respect to tritium—I know you know this, but many of your colleagues do not fully appreciate it—with the question of tritium, the issue really isn't quantity. No matter what conceivable thing could happen to our stockpile between now and the year 2000 or 2010, we are going to need tritium. The only capability we have today to produce it is represented by those Savannah River reactors.

So, no fluctuation due to arms control or any other conceivable thing is going to change the fundamental fact that we have to have a new production facility.

Senator MCCLURE. Just for the record, and I will submit a number of these questions for the record, but just for the record, with respect to the two-reactor strategy, Under Secretary Salgado is quoted in the Pasco Tri-City Herald as saying that he acknowledges that "DOE is bucking this directive." He is quoted as saying, "We have been asked by Congress to give it an acquisition strategy for NPR's plural. Our strategy essentially is that we are looking at an NPR and, if mandated by law, we will look at a second NPR." That is, I guess, one of the reasons for my heightened concern about whether or not the ERAB panel really has the flexibility to make a decision different than that, and whether or not, if they do, it will be ignored.

Mr. WADE. Certainly the output of ERAB, sir, will be advisory to the Secretary, and the Secretary will make the final decision.

I think the Secretary will take into account, however, exactly, what ERAB says, knowing that whatever decision he makes is going to receive a lot of scrutiny.

I believe Under Secretary Salgado's concerns are economic in nature and nothing more than that. I will provide additional information for the record.

[The information follows:]

NEW PRODUCTION REACTOR

The fiscal year 1988 appropriation bill directed the Department in its report to Congress on the NPR to "* * * include an analysis of whether or not the acquisition strategy should provide for the procurement and construction of two or more replacement production reactors * * *" The number of reactors needed depends on (1) how much material can be made by one reactor, and (2) the amount of material needed. Both of these factors are being investigated. We are now conducting studies of alternative reactor technologies to determine, among other things, the capability of each technology for production of weapon materials. We are also evaluating the long-term national needs for weapon materials. We are, of course, coordinating this study with the Nuclear Weapons Council. Our final report to Congress in July 1988 will contain the Department's recommendation as to the number of replacement production reactors needed and the basis for the Department's recommendation.

Senator McClure. I note it is past the time you said you had to go. If you need to catch that plane, I want you to.

Mr. Wade. All right. [Laughter.]

If you would excuse me, sir, General Kavanaugh, Ms. Lytle, and Dr. Gilbert can answer far better than I anyway.

Senator McClure. Thank you very much. And I will see you in Boise tomorrow.

Mr. Wade. All right.

JOINT VERIFICATION EXPERIMENT

Senator McClure. I noticed that the exchange of information and data at the test sites between the United States and the Soviet Union is going to involve the use of a Soviet device at the Soviet site with United States monitoring. Is that correct?

Dr. Barker. That's correct, Senator.

Senator McClure. And a United States device at the United States site with Soviet monitoring. Is that correct?

Dr. Barker. That is correct.

Senator McClure. Doesn't that inject into the results some degree of uncertainty as to what it means because you don't know exactly what the device is, what the deal is?

Dr. Barker. What was very interesting about the advancing November meetings in Geneva was that the Soviet side proposed using a hydrodynamic yield measurement technique, essentially CORRTEX, in the hole with the explosives to be the standard of yield. So they acknowledge that hydrodynamic yield measurements are so accurate in the hole with the device that they have agreed—and we agree with their assessment of this accurate measurement technique—that that will be the standard of yield. And so we will be comparing a satellite CORRTEX measurement with a down-hole CORRTEX measurement.

Senator McClure. So there will be a down-hole measurement, not just the seismic?

Dr. Barker. No. Heavens, no, no.

The standard of yield which the Soviets proposed was a replacement better than the cube measurement.

Senator McClure. All right.

SUBMITTED QUESTION AND PREPARED STATEMENTS

I have a question to submit for the record, but I will not detain you further at this time.

In addition, we will also include the prepared statements from the other program heads.

Thank you very much. I appreciate your testimony.

Dr. Barker. Thank you Senator

[The question and answer and statements follow:]

QUESTION SUBMITTED BY SENATOR DOMENICI

INERTIAL FUSION RESEARCH

Question. The March 22 headline of the New York Times raised the question of the merits of alternatives that are being considered for inertial confinement fusion options for fabrication of a micofusion facility. Competing technologies include particle beam and laser fusion. The Times article claimed that there was uncertainty about the relative merits of HF, KrF, and glass laser technology. Constituents have suggested that our office request the National Academy of Sciences to review the ICF Program and reconsider the recommendations made in their last review. Others have claimed that a congressional inquiry should be made. Please inform me of DOE's position on these issues.

Answer. The goal of inertial fusion research is to determine the feasibility and affordability of achieving thermonuclear fusion in the laboratory. This capability would allow for detailed study of physical processes which are important to a better understanding of nuclear weapons and to the development of commercial electric power. The strategy for achieving this goal includes determination of the requirements for an optimal fusion target design, the minimum energy required to initiate fusion in the target, and the nature of target driver best suited to initiate the fusion reaction. Each of the driver technologies being considered offers different options in terms of energy, wavelength, cost, efficiency, technical readiness, and ability of the beam to drive the target to fusion.

Within the management of inertial fusion research, the DOE conducts a continual technical review of all ongoing programs to evaluate progress and provide the basis for future program directions. Specifically, the Department has recently completed a detailed technical review of the KrF laser technology using qualified outside experts and is preparing to conduct similar reviews for each driver candidate technology. These reviews will become inputs, along with similar reviews of target development, into a more comprehensive review of the overall program's progress toward the ultimate goal of a capability to achieve fusion in the laboratory. Any decisions concerning the construction of a laboratory microfusion capability and the selection of the most appropriate driver will be based on the findings of these reviews as well as on the need and cost for such a capability.

STATEMENT OF BRIG. GEN. PAUL F. KAVANAUGH, U.S. ARMY, DEPUTY ASSISTANT SECRETARY FOR MILITARY APPLICATION

Mr. Chairman, members of the committee, it is a pleasure to appear before you to testify in support of the Department of Energy (DOE) Atomic Energy Defense Activities Authorization request for fiscal year (FY) 1989.

INTRODUCTION

1. THE DOE MISSION AND U.S. NATIONAL SECURITY STRATEGY

Our national security strategy is designed to protect U.S. basic freedoms, and avoid international war and coercion through nuclear deterrence. The national security strategy postulates movement toward strategic defense in balance with offensive systems; movement toward bilateral, verifiable reductions in nuclear arms; consideration of less reliance on underground nuclear testing on a technically justified basis.

In support of this strategy, DOE is charged with the mission of developing and maintaining nuclear warheads for the Nation's nuclear deterrent forces. A viable nuclear deterrent must include a credible deployed weapons stockpile and a robust research, development and testing program to develop and modernize tomorrow's nuclear stockpile for as long as we have a nuclear deterrence policy. That stockpile must be configured to respond to future advanced technologies, both nuclear and nonnuclear. It must respond to and anticipate changes in adversary offensive and defensive target sets, and advances in weapons and delivery systems affecting the effectiveness, survivability and/or vulnerability of our existing and future nuclear deterrent forces. DOE must also respond to nuclear weapon stockpile modernization for safety, security, and use control in conjunction with military requirements.

Providing the Nation with a credible nuclear deterrent also involves avoiding technological surprise. A key component of this includes supporting the President's Strategic Defense Initiative. Strategic defense research related to nuclear directed energy is necessary to understand the Soviet counter-defensive capabilities against both a future U.S. strategic defense system and our existing retaliatory nuclear deterrent as well. It is also important to understand nuclear directed energy weapons as a U.S. strategic defense option, if needed.

2. CONTINUING REQUIREMENT FOR NUCLEAR DETERRENCE AND THE NECESSARY PROGRAM RESPONSES TO MEET EVOLVING NATIONAL DEFENSE POLICY ISSUES

The theme that I will stress throughout my testimony is the continuing requirement for nuclear deterrence and the need to preserve the capability to restructure or adapt the composition and level of the nuclear force structure in response to evolving national defense policy issues. I will discuss what these issues are and the necessary DOE responses. The fundamental DOE response is the maintenance of U.S. nuclear competence.

I intend to discuss four major topics in the remainder of my statement: the elements of nuclear competence, the evolving policy issues, the implications of the issues to our program, and, finally, the major accomplishments and FY 1989 budget request for programs.

3. NUCLEAR COMPETENCE - THE FUNDAMENTAL RESPONSE

Nuclear competence is essential to ensure a viable nuclear deterrent. This competence is comprised of several primary components. A fundamental component is the scientists and engineers in our nuclear weapons laboratories experienced in the technologies pertinent to nuclear weapons design, development, testing, and production support. Another fundamental component is the scientists, engineers, and technicians in our weapons production plants. An integral component of nuclear competence is the continued ability to conduct nuclear testing on a technically justified level to support our research to avoid technological surprise, conduct development programs for new weapons to address changing threats, and to maintain our existing weapons stockpile. Testing is a critical element in any experimental program and, in the case of nuclear weapons research, underground testing is essential to obtain the necessary scale that cannot be obtained in the laboratory. Moreover, for nuclear weapons scheduled to enter the stockpile, it is important that we test thoroughly just as the Department of Defense does for its delivery systems. Finally, modern equipment, computers, and facilities supporting our scientists and engineers are another integral component of nuclear competence. Simply stated, nuclear competence is diversely educated and experienced people; state-of-the-art computers; and, specialized equipment and facilities.

The scientific, engineering, and technological response capability encompassed in nuclear competence is, and will continue to be, essential in a dynamic technological and political world. This capability must be preserved to respond to transitions in military doctrine, force structures, arms control initiatives, and additional nuclear testing restrictions.

Nuclear weapons competence must be preserved, inasmuch as it exists nowhere else in the U.S. and it cannot be readily restored if any of its components are significantly degraded or eliminated. In fact, the capabilities of our nuclear weapons laboratories and the production complex are national assets and the mere preservation of their capabilities has a valuable deterrent effect on the Soviet Union, as do the actual warheads designed and produced. This competence is critical to avoid technological surprise, provide response capability for military requirements, and also protect the national security in the event of any treaty breakout. Accordingly, the weapons complex, and the nuclear competence it represents, must at all times be preserved at a prudent level until such time that the world's nuclear weapon stockpiles are reduced to zero and nuclear deterrence no longer is U.S. national policy. The necessary investment in nuclear competence is relatively very minor in the context of national defense spending considering the leverage provided by the nuclear deterrent to national and international security.

4. EVOLVING NATIONAL DEFENSE POLICY ISSUES AND PROGRAM RESPONSES

The nuclear weapons program is faced with several evolving national defense policy issues in providing the nuclear warheads to the Department of Defense for the Nation's nuclear deterrent. These issues relate to arms control initiatives, strategic defense, potential additional restrictions on underground nuclear testing, reliability and adequacy of tritium and plutonium supplies, and the maintenance and operation of the aging complex in a secure, safe, and environmentally acceptable manner. All of these issues will place a number of demands on the DOE nuclear weapons program.

ARMS CONTROL

Progress in arms control requires a reevaluation of the composition and level of the nuclear weapons stockpile. It also necessitates a technical response to address military requirements in the context of the agreements. Although the superpowers may relinquish a part of their nuclear weapons stockpiles, they will not relinquish their superpower military status. In an environment of shrinking stockpiles, the remaining nuclear weapons will assume an even greater role in providing an acceptable level of deterrence and stability between the superpowers. Therefore, the capability or nuclear competence of DOE must be preserved for the foreseeable future.

As you know, the Administration has sucessfully negotiated an agreement with the Soviets concerning intermediate nuclear forces and is actively engaged in Strategic Arms Reductions Talks (START). Within the context of these agreements DOE will be called upon to maximize the capability and reliability of the stockpile that remains.

However, even within the context of any arms control agreements, there may develop or still exist a number of Soviet military targets that the U.S. cannot hold at risk and new warhead designs may be necessary as a result. In addition, new warhead designs may be necessary to accommodate advances in nonnuclear technologies such as advances in missile accuracies and stealth characteristics. Consequently, new warhead designs may be required to accommodate more restrictive space geometries and/or volumes; more demanding yield to weight ratios; and, new stockpile to target sequences. There will continue to be a need to modernize nuclear warhead safety, security, and command and control technology. At all times, DOE must preserve its capability to assess adversary threats and avoid technological surprise. All of these responsibilities remain with DOE within the confines of any international agreements.

In addition to the reevaluation of the composition and restructuring of a new nuclear weapons stockpile within the context of any negotiated Intermediate Range Nuclear Forces (INF) and/or Strategic Arms Reductions Talks agreements, DOE will be called upon to assess parity and verification matters related to arms control. Arms control will hopefully lead to greater stability; however, the DOE weapons program must remain strong to achieve and maintain nuclear weapons deterrence within the context of any agreements.

STRATEGIC DEFENSE RESEARCH

The Administration has accelerated strategic defense research. Quite possibly, strategic defense research may ultimately lead to a national strategy of strategic defense in combination with or in lieu of the offensive nuclear deterrent. Greater reliance on mutually assured defense rather than mutually assured destruction may be possible in the future.

The Department must research nuclear directed energy weapons to avoid technological surprise by the Soviet Union. We must understand the Soviet nuclear directed energy weapons capability to threaten proposed nonnuclear strategic defense architectures, and also to determine the feasibility of nuclear directed energy weapons as a strategic defense option, if necessary. It is also critically important to understand the nuclear directed energy weapons threat to our current nuclear deterrent forces. DOE must maintain a viable effort as part of the Strategic Defense Initiative (SDI) and also as part of its responsibility to ensure a viable nuclear deterrent.

Although strategic defense may provide an additional major disincentive for a Soviet offensive strike and eventually dramatically reduce the number of offensive nuclear warheads, some offensive nuclear warheads will probably be necessary to ensure nuclear deterrence. A technical response to new military and modernization requirements for those remaining weapons will be necessary.

POTENTIAL ADDITIONAL RESTRICTIONS ON UNDERGROUND NUCLEAR TESTING

Another national defense policy issue facing the nuclear weapons program is the possibility of greater restrictions, below the 150 kiloton yield limit, on underground nuclear testing. In addressing such a challenge we must first understand the implications of any additional restrictions on the capability of our weapons laboratories to certify, with acceptable confidence, the performance of specific features of current weapon design concepts and to develop new warhead designs to meet future military requirements. If we are to avoid any unacceptable limitations in maintaining our nuclear deterrence, it will be necessary to intensify underground nuclear testing for a sustained period before we are able to responsibly assess our ability to maintain the nuclear deterrent and nuclear competence with greater restrictions on testing. The Department is developing a report, as requested by Congress, to assess the feasibility of reduced reliance on nuclear testing. We will be expanding on many of the issues I will discuss today. However, it is clear that nuclear testing will always be necessary in support of a truly dynamic research and development program and to verify with confidence the performance of the deployed stockpile.

NUCLEAR MATERIALS SUPPLY

A critically important national defense policy issue is meeting the demand for tritium and plutonium for the nuclear deterrent. Our production reactors and processing facilities are becoming increasingly fragile. A reliable source at the appropriate capacity for the new production of these materials is essential to our nuclear deterrence. This responsibility, upon which the success of the nuclear weapons program is dependent, is assigned to the Deputy Assistant Secretary for Nuclear Materials Production.

DOE will be placing the N Reactor at the Hanford Site in a cold standby status. We project the nuclear materials requirements of the Department of Defense (DOD) can be met through recycle and reclamation of materials and the operation of the three reactors at Savannah River.

Plans are also in place to assure a tritium supply in the late 1996-1999 time period with replacement reactor capacity. It is critical that we restore our capacity for manufacturing tritium now. The need for additional plutonium and oralloy will be determined depending on Strategic Arms Reductions Talks and force requirements. These materials do not decay for thousands of years. Tritium decays with a 12 year half-life. It is critical to the operation of virtually all nuclear weapons. There is no alternative, and losing our tritium is tantamount to unilateral disarmament. Special Isotope Separation technology will provide a limited reactor-independent supply of plutonium by 1995.

Nuclear material for weapons production and stockpile maintenance is also achieved through reclamation and recycling activities within the weapons complex as part of my responsibility. In conjunction with these activities, it is critically important that we have a viable set of facilities at the Rocky Flats, Savannah River, and Y-12 Plants.

The Plutonium Recovery Modification Project at Rocky Flats, the Enriched Uranium Recovery Improvements Project at Y-12, and the Tritium Loading Facility Replacement at Savannah River Plant are major construction projects that will help to preserve this capability.

OPERATION OF THE COMPLEX IN A SAFE AND ENVIRONMENTALLY ACCEPTABLE MANNER

Operating the weapons complex in a safe and environmentally acceptable manner is another national defense policy issue. Safety and environmental oversight are likely to intensify and DOE is committed to respond to these concerns as well as program requirements. With an aging complex, a legacy of environmental issues accumulated over 40 years, and increasingly stringent regulations responding to all these concerns will be a major challenge.

The Department has been taking extensive actions to be assured that its operations are safe and environmentally acceptable. The Secretary has undertaken a series of new initiatives through the issuance of new orders, the provision of internal oversight, and plans for independent external oversight in order to assure compliance within the Department with the many new nuclear safety requirements. In the environmental area, negotiations have been initiated with many of the state environmental regulatory agencies and the Environmental Protection Agency (EPA) in order to establish compliance agreements which will be legally binding. All of these actions will impact the FY 1989 and future year budgets.

OPERATION OF THE COMPLEX IN A SECURE MANNER

Operation of the complex in a secure manner is also a key national defense policy issue. Although threat scenarios are dynamic and present an ever changing challenge, advancements in safeguards and security technology present new methods to mitigate identified facility concerns in a timely and cost-effective manner. We are responding to this challenge, in part, by developing at our key facilities plans entitled Master Safeguards and Security Agreements (MSSA) which document the security systems facility management will employ in responding to the spectrum of threats. Periodically, evaluations are conducted by various DOE organizations to assess program effectiveness and to recommend corrective actions.

MAINTAINING THE WEAPONS COMPLEX

The nuclear weapons complex is currently in a state of fragility as a result of emphasizing nuclear weapon system production to meet military requirements within available funding resources. Ultimately, this shortsighted approach will cripple our ability to avoid technological surprise and respond to nuclear weapon system production in the future. Timely replacement of capability is necessary to avoid fragility. The challenge facing the nuclear weapons program is a proper balance of support for near-term weaponization and long-term capability of the weapons complex within realistic funding profiles. Our response to restoring and maintaining the complex is incorporated in the Nuclear Weapons Research, Development and Testing Revitalization Program, Facility Capability Assurance Program, and General Plant Projects Program. All of these programs encompass the construction projects necessary, in balance with programmatic requirements and funding, to ensure the long-term capability of the nuclear weapons complex.

5. SUMMARY OF THE PROGRAM IMPLICATIONS IN RESPONDING TO EVOLVING NATIONAL DEFENSE POLICY ISSUES

In summary, there are a number of implications for our program in restructuring or adapting the nuclear forces in response to these issues. We must be able to maintain and improve our capability to: develop nuclear weapon warheads to meet new military requirements within the context of any arms control agreements; retrofit and/or replicate existing nuclear designs in the event of severe restrictions on nuclear testing; assess the effects of nuclear weapons on military assets; avoid technological surprise; assess parity and verification issues; and understand nuclear directed energy weapons to evaluate their effect on strategic defense systems and/or their contribution to deterrence in combination with strategic offensive nuclear forces.

As we address the programmatic requirements, we will also take the necessary actions to operate the weapons complex in a secure, safe, and environmentally acceptable manner. We must also ensure that the long-term viability of the current fragile weapons complex is addressed by steady progress in maintaining and restoring aging utility systems and facilities.

The response to these challenges will require a vital DOE weapons program, which in turn requires nuclear weapons competence. It is simply incorrect to anticipate a future requiring less weapons research, development and testing or an absence of productive capacity for a modernized nuclear weapons stockpile while nuclear deterrence remains national policy.

Major efforts are underway to quantify the response to those evolving policy issues. We have underway a modernization study of the weapons complex and a study to assess the feasibility of reduced reliance on nuclear testing. Each of these studies will be submitted to all of our cognizant authorization and appropriation subcommittees as directed by Congress. The findings of these studies and the corresponding discussions should prove helpful as the Administration and Congress chart the course of the nuclear weapons program. We are also monitoring any arms control impacts on nuclear testing as requested by Congress, and DOE will keep you informed of key developments.

At this time, I would like to present you with the major accomplishments and FY 1989 budget request for our programs.

6. MAJOR ACCOMPLISHMENTS AND FY 1989 BUDGET REQUEST FOR WEAPONS ACTIVITIES

SUMMARY OF FY 1989 BUDGET REQUEST FOR WEAPONS ACTIVITIES

The FY 1989 budget was formulated in view of the greatly constrained budgetary situation facing the entire Federal Government. Military requirements notwithstanding, DOE, following the lead of DOD, significantly reduced its request for FY 1989 funding after the FY 1988 Budget Summit, which set budget targets for both FY 1988 and FY 1989 spending levels for all Federal Government programs.

A careful balance has been achieved between the requirements for today and the needs for tomorrow. In the forum of the Nuclear Weapons Council, nuclear weapon production requirements were reexamined jointly by the Departments of Defense and Energy, resulting in major reductions in some future systems, as well as modified projections throughout the planning period. Further adjustments to these schedules may be required to accommodate budget constraints in the outyears. Conversely, there has been a recognition that the long-term capabilities must be maintained. The Facilities Capability Assurance Program in our nuclear weapons production complex, our revitalization efforts at the research and development (R&D) laboratories and the Nevada Test Site (NTS), and our general plant projects are all supported to preserve and upgrade the long-term capabilities of the nuclear weapons complex.

The FY 1989 budget request for Weapons Activities totals $4,256.9 million as presented by major activity in this chart (Chart 1). Based on a 3 percent escalation rate, the FY 1989 request for Weapons Activities programs will be about 2 percent below FY 1988 levels. Specifically, this means that: 1) nuclear weapon stockpile requirements, as agreed to by the Nuclear Weapons Council, shall be supported for FY 1989; 2) research continues on nuclear directed energy weapons and Inertial Fusion programs at the FY 1988 pace; and, 3) the research, development and testing core activities must be constrained to below the FY 1988 level of effort. The request supports minimum requirements to restore our aging facilities and to maintain operations and projects required to assure the continued secure, safe, and environmentally acceptable operation of this Nation's nuclear weapons facilities.

WEAPONS RESEARCH, DEVELOPMENT AND TESTING

OVERVIEW

The nuclear Weapons Research, Development and Testing (WRD&T) Program provides the primary scientific and technological underpinning for U S. nuclear deterrence. At present, nuclear deterrence provides the highest leverage for national security per dollar spent. U.S. national security rests on defense technologies, the capability to respond to new threats, and avoidance of technological surprise. The goals of the Weapons Research, Development and Testing program are to ensure continued and improved safety, security, and reliability of the existing stockpile of nuclear weapons; provide design, engineering development, and testing for new weapon concepts and engineering support for new weapons entering the stockpile; maintain the scientific and engineering capability to provide a continuing flow of technical knowledge and innovations to support the development of new weapons; and avoid technological surprise by an adversary. The Weapons Research, Development and Testing Program activities are key elements in applying atomic energy technology to the common defense as vested in the DOE weapons program by the Atomic Energy Acts of 1946 and 1954, as amended. This program is vital because nuclear deterrence has been and continues to be the foundation of U.S. national security.

This program provides for the efforts performed by the Lawrence Livermore National Laboratory (LLNL), the Los Alamos National Laboratory (LANL), the Sandia National Laboratories (SNL), the Nevada Operations Office (NVO), and other contractors in research and development of nuclear weapons. This includes research, development, engineering, and certification of nuclear warheads required by DOD for stockpile, investigation of concepts and technologies for future weapons, and advancement of the sciences and technologies applicable to nuclear weapons as well as related research on and threat assessment of nuclear directed energy weapons (NDEW) for the national Strategic Defense Initiative Program. Inertial Fusion activities are incorporated into the Weapons Research, Development and Testing Program because of their contribution to the weapons technology base.

CORE PROGRAM

The major program elements of the Weapons Research, Development and Testing Core Program are the technology base; weapons development, engineering, and certification (WDEC); and underground nuclear testing. We are requesting $1,465 million for the Core Program in FY 1989 as seen in this chart (Chart 2).

The technology base is the fundamental component that assures nuclear competence for the Nation's nuclear defense program. It is unique and brings together diverse scientific and engineering expertise (people), applied and scientific knowledge, and specialized equipment, facilities, and data bases into a capability which is fundamental for responding to U.S. security needs in the long term. Programmatically, the Core Program is made up of the technology base directed toward all three generations of nuclear weapons: fission (high explosives, hydrodynamics, fission physics); fusion (boosting, radiation flow, radiation compression, fuel burn); and tailored outputs (x-ray, gamma-ray, electromagnetic, laser, *Deleted*

Weapons development, engineering, and certification activities are guided by current national security requirements for providing new strategic nuclear weapon options, and for maintaining the reliability and improving safety and security of all nuclear weapons now in stockpile.

Underground nuclear testing is an integral and essential part of the overall weapons research, development and testing effort. Currently, we rely on underground nuclear testing to measure the performance of stockpile weapons. This is the only way that we can assure that our stockpile is safe and reliable. Furthermore, our underground test program is essential for studying the complex processes critical for understanding and improving nuclear weapons. There are no above-ground test facilities that enable us, at present, to measure the physical processes by which nuclear energy is released in a nuclear explosive.

ACCOMPLISHMENTS

The Core Program achievements for FY 1987 and thus far in FY 1988 have been outstanding. Our accomplishments have helped confirm our confidence in the nuclear weapons stockpile, have permitted us to make significant advances in new nuclear design technologies, have included experiments designed to better understand device physics, and have provided nuclear sources or assistance for others. Especially noted are:

- Testing performance for stockpile warheads within the constraints of the Threshold Test Ban Treaty yield limit, and for improved safety *Deleted* *Deleted*
- Developing options for new nuclear systems for DOD *Deleted* *Deleted*
- Designing and executing innovative experiments directed toward new design concepts, exploratory research in weapons physics and fundamentals of stockpile reliability

Deleted

Work-for-Others including devices for Defense Nuclear Agency (DNA) effects experiments - Deleted Deleted and assistance to the United Kingdom.

During this period, Deleted tests were conducted in the technology base program. Deleted tests explored the physics of nuclear devices which address fundamental reliability issues. Deleted tests studied the fission and fusion processes of primaries.

Deleted

Finally, Deleted tests were conducted to support work-for-others.

Deleted

tests were conducted by the Defense Nuclear Agency for their effects experiments

Deleted

The supporting technologies made important contributions to the Core Program accomplishments. Significant improvements in nuclear weapon safety were made.

Deleted

FY 1989 PROGRAM PLANS

For the remainder of FY 1988 and FY 1989, we plan to continue a balanced program among the non-Strategic Defense Initiative categories: weapons development, engineering, and certification, advanced design technologies and fundamentals of stockpile reliability. In weapons development, engineering, and certification we have scheduled nuclear tests of stockpile weapons and for further characterization and improvement of the designing of our Phase 3 weapons, Deleted In the advanced development category we will have nuclear tests for various Phase 1,2 activities

Deleted

We also have an active program planned in our fundamentals of stockpile reliability category.

Important tests are scheduled to better understand boosting in primaries, radiation flow, and secondary ignition and burn. Included in this category will be tests critical to stockpile reliability in an era of fewer or lower yield tests. Finally, we will continue to support the Defense Nuclear Agency, Deleted, and the United Kingdom by providing nuclear devices or assistance for their various research efforts. The Joint Verification Experiment (JVE) is still being negotiated and its circumstances are uncertain. It is not explicitly shown in the FY 1988 budget request. If this test becomes certain, Deleted Deleted. This would have minimum impact on our program; however, it is still likely that one of the technology base tests will have to be deferred until FY 1990 to provide resources for this experiment.

The supporting technologies will continue to be directed toward maintaining the nuclear competence required to assure stockpile safety and reliability, and to avoid technological surprise. Research and development (R&D) will be conducted across the full spectrum of nuclear weapon activities: physics, computation sciences, material sciences, chemistry, and engineering. These R&D activities will have several important payoffs. They will provide new and improved data based in the atomic and nuclear physics. Better computational facilities and modeling codes for better predictive capabilities. Aboveground testing facilities will be expanded for acquiring the basic physics data and validating computer modeling codes. These facilities cannot replace underground testing but will be complementary to our underground program.

EMERGENCY RESPONSE PROGRAM

ACCOMPLISHMENTS

The Department maintains a diverse program of technical expertise, specialized equipment, and uniquely capable personnel to effectively respond to the wide spectrum of accidents and incidents which may directly or indirectly affect the Department's weapons complex or call for the use of its assets to respond to requests for assistance from others, on a worldwide basis. This program is constantly reviewed to assure its ability to meet existing needs and to prepare the capabilities to meet future needs. This year we have instituted a program to further enhance the integration of our individual assets to assure effective coordination and to better interface with other local, Federal, and international response assets. We have also participated in numerous exercises, both Departmental and jointly conducted, with other Federal and international response assets. The Department has instituted a program to revisit lessons learned in previous exercises to assure timely implementation of corrective actions. All of this is to assure that we maximize the benefits from our exercise program. We continue to upgrade our program for specialized equipment acquisition and maintenance and to develop a program for enhancing the specialized training provided to our response personnel as well as special personnel from other response assets. Along with these activities, we are continuing to institutionalize our support arrangement with others and, working with the Department of State, to develop a coordinated approach for providing assistance to other nations, including assisting them in developing their own assets.

NUCLEAR DIRECTED ENERGY WEAPONS

OVERVIEW

The purpose of the Strategic Defense Initiative (SDI) is to eliminate the threat posed by strategic nuclear missiles. There is a role for DOE within the Strategic Defense Initiative because of our charter to research nuclear energy applications, given in the Atomic Energy Act. By agreement between Secretary Herrington and Secretary Weinberger in 1985, the DOE role is defined in three areas. First, we are thoroughly analyzing several concepts to find out if an adversary can develop nuclear directed energy weapons that would negate a nonnuclear strategic defense system. Next, we want to understand the effect on our strategic retaliatory forces if an adversary were to develop and use nuclear directed energy weapons concepts in a Strategic Defense Initiative-like system. Finally, we want to preserve a U.S. option to use nuclear-driven defensive weapons as a component in the Strategic Defense Initiative should it be deemed to be in the country's interest. Our participation in the Stratetic Defense Initiative is closely coordinated with DOD.

Because of restricted funding levels over the past 2 years, we have pursued a level of effort that is less than we might have planned. We have made both vertical cuts by eliminating concepts from consideration and horizontal cuts by reducing the level of effort since last year. As depicted in tbis chart (Chart 3), we are requesting a total of $285 million in FY 1989 for nuclear directed energy weapons. At this point, we are continuing investigation into x-ray lasers, optical frequency lasers, and hypervelocity projectiles at the DOE laboratories, with attendant systems analysis and vulnerability, lethality, and countermeasure studies. Nuclear directed energy weapons technology does not interfere with our basic mission but rather is an extension of the core technology base. The technical feasibility milestone dates have moved *Deleted* , delaying a concept feasibility determination

Deleted

ACCOMPLISHMENTS

The achievements obtained in FY 1987 and thus far in FY 1988 are impressive, as described below.

X-RAY LASERS

Deleted

HYPERVELOCITY PROJECTILES

Another nuclear directed energy weapons concept, the Deleted nuclear-driven hypervelocity projectiles concept, can be likened to a nuclear-driven shotgun. We believe that hypervelocity projectiles, propelled by a nuclear explosive device over long distances, will be able to inflict catastrophic damage to the full spectrum of strategic defense targets.

In FY 1987, key issues were identified by Los Alamos National Laboratory regarding necessary conditions for driving projectiles, using computer programs and above-ground, high-explosive tests. This gives added direction and focus to future activities in the program.

Deleted

. This will allow repetitive testing, in a laboratory environment, to obtain basic data needed to support later, more complex experiments. Additional above-ground tests looked into other areas such as developing diagnostic tests and instrumentation for this new and unique technology to provide greater understanding of basic physics and engineering issues.

Mission and systems analyses were completed for this concept

Deleted

OPTICAL FREQUENCY LASERS

Deleted

The FALCON reactor-pumped laser at Sandia National Laboratories achieved lasing in a laboratory experiment on an existing research reactor. Experiments to increase laser output are underway.

The Idaho National Engineering Laboratory is investigating the CENTAURUS reactor-pumped continuous wave laser concept. A laboratory test is planned on an existing reactor to measure laser gain later this year. This is the first technical milestone in the CENTAURUS program.

FACILITIES

While construction for DOE's nuclear directed energy weapons program is limited, it has been successfully on time and within budget. Work on the shared DOE and Strategic Defense Initiative Organization (SDIO) funded Strategic Defense Facility at Sandia National Laboratories, Albuquerque, New Mexico, is progressing on schedule. Phase 1, the light laboratory and office building, is under construction, and design definition approval for Phase 2, the directed energy experimental building, was granted by the Assistant Secretary for Defense Programs in September 1987. The facility will be used to support research on the x-ray laser, microwave generators, pulsed powers, electromagnetic launcher, and other Strategic Defense Initiative projects.

FY 1989 PROGRAM PLANS

For FY 1989 we are planning a very ambitious and exciting nuclear directed energy weapons program.

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The FALCON nuclear reactor-pumped optical laser program will attempt to demonstrate a laboratory-scale laser of *Deleted* output on an existing reactor facility. This energy output level for FALCON is a required program milestone before further FALCON research and development would be approved.

Construction of the Strategic Defense Facility's light laboratory/office building should be completed, and installation of laboratory equipment should commence, in preparation for experimental activity in early FY 1990.

In summary, each of the three nuclear directed energy weapons concepts is being vigorously pursued, to the extent possible with the available funding. While technical feasibility dates have been delayed, DOE nuclear directed energy weapons studies should provide critical information to DOD decision-makers on the possible effect of nuclear options on strategic defense and offense.

INERTIAL FUSION

OVERVIEW

The Inertial Fusion Program is part of the weapons research, development and technology base. Its mission is to enhance the national security of the U.S. by contributing to advanced military and civilian technologies. We do research to determine the feasibility and affordability of laboratory microfusion using a laser or particle beam initiator. In FY 1987, major accomplishments were achieved in experiments with the NOVA laser *Deleted* *Deleted* . We are now to the point where all but the most severe critics agree that the basic feasibility of the target physics has been proven. We are in the exciting position of beginning to plan for the next step: a large inertial confinement fusion applications facility that can produce up to a thousand million joules of energy, equivalent to a quarter-ton of high explosive. Such a facility would have long term important and highly significant military applications, including experiments on selected weapons physics issues pertaining to design, diagnostics, nuclear directed energy weapons, nuclear weapons radiation effects simulation, and nuclear hardness and survivability testing. However, we must provide a note of caution here. No facility of this type is a substitute for nuclear testing. Inertial confinement fusion may be able to examine physics issues of nuclear explosives, but does not scale to weapons. The facility, which is just in the beginning planning stage, would also contribute to civilian applications, such as the development of a nearly inexhaustible energy supply from electrical generators powered by inertial confinement fusion.

The target physics program, advanced driver development, and planning for the Laboratory Microfusion Facility (LMF) will be supported by the FY 1989 budget request of $164 million (Chart 4). This budget level is consistent with the National Academy of Sciences recommendation of level of effort funding. As a result of the historic results obtained in target physics in FY 1987, Inertial Fusion Program resources will be allocated to help strengthen driver technology, which now appears to be on the critical path to a laboratory microfusion capability.

ACCOMPLISHMENTS IN FY 1987

The Inertial Fusion Program has achieved historical results in 1987 and has reached a major turning point.

Deleted

At Lawrence Livermore National Laboratory, the NOVA laser (Chart 5) was used to create a uniform distribution of x-rays used to implode a capsule filled with gaseous fuel. The capsule compressed more than 30 times in radius (equivalent to squeezing a softball to a bb-size pellet). This is near to the laboratory fusion capsule design requirement of 40 times compression in radius needed to achieve high-gain. Frozen thermonuclear fuel capsules were imploded by spherically symmetric laser irradiation for the first time on OMEGA (Chart 6) at the University of Rochester.

Concern over possible deleterious effects of a fusion capsule instability was reduced by discovery at the Naval Research Laboratory of a self-healing effect in direct-drive pellets. Scientists at KMS Fusion fabricated many high quality targets for NOVA and OMEGA experiments.

The recommendations of the National Academy of Sciences Happer Panel review of the U.S. Inertial Fusion Program, completed in 1986, included assignment of top priority to target physics issues, with an evaluation of progress in 5 years. The excellent agreement of computer calculations *Deleted* *Deleted* with the results of target performance on NOVA experiments indicates that many of the target physics issues of concern to the Happer Panel have been successfully answered even sooner than anticipated.

Significant accomplishments also occurred in Inertial Fusion driver technologies. New world records were set in pulsed power energy storage and synchronization on PBFA II light ion accelerator at Sandia National Laboratories (Chart 7).

The AURORA KrF gas laser beams (Chart 8) at Los Alamos National Laboratory were successfully transported through the intermediate amplifier, and the complete optical system was installed.

PROGRAM PLANS

Because of the FY 1987 accomplishments, the program is undergoing re-planning, with the major goal of determining feasibility and affordability of a Laboratory Microfusion Facility in the late 1990s. This requires new developments in advanced driver technology, while maintaining the present level of effort in the fusion capsule physics program. A decision date of 1991-1992 to choose the Laboratory Microfusion Facility driver is necessary to provide the capability by the late 1990s. A Laboratory Microfusion Facility providing thermonuclear capsule energy output of 100 million to 1 billion joules can have significant impact on nuclear hardness and survivability testing and on certain weapon physics issues. This capability would be synergistic with underground nuclear tests, but could not replace the need for underground testing. The Laboratory Microfusion Facility would also contribute to advances in nuclear design capability, high-speed diagnostic instrumentation, and nuclear directed energy technology. In addition to the direct benefit to military programs from experiments in a Laboratory Microfusion Facility, there would be the less tangible, but extremely important benefit of useful training and experience provided to maintain a professional cadre of physicists, engineers, and test personnel in an area related to nuclear weapon physics. The studies of high gain thermonuclear capsule designs with a Laboratory Mirofusion Facility will also provide direct benefit for development of commercial power generation, through the development and demonstration of cost effective high-gain fuel pellets.

The new program planning strategy incorporates independent program reviews for each of the candidate driver technologies which could be developed in time to provide a Laboratory Microfusion Facility capability by the late 1990s. Outside experts in each driver technology will review the technology base being generated to determine the capability to meet the required driver performance, the critical driver cost factors, and the driver affordability. In addition, a laboratory microfusion capability study is proceeding under the direction of the Division of Inertial Fusion at Headquarters, DOE, to define the potential applications and benefits of a Laboratory Microfusion Facility, and to address the driver-independent (Phase I) and driver-dependent (Phase II) configurations and cost estimates of such a capability.

FY 1988-1989 MILESTONES

In FY 1988-1989, the program will continue to concentrate on target physics studies with Deleted NOVA, and OMEGA, and on driver development with PBFA II and AURORA.

Deleted

On NOVA, installation of new "platinum-free" laser glass will be completed, allowing experiments to address pulse-shaping and hohlraum physics at higher energy. Advanced solid-state laser development will continue for application to a multi-megajoule laser. On PBFA II, lithium ion beam generation and focusing to sufficiently high power in FY 1988 will allow ion beam hohlraum experiments in FY 1989. Pulse-shaping of light ion beams by transport in plasma channels and through a new pulsed power technology will also be developed in FY 1989. The AURORA KrF experiment will reach the multi-kilojoule level of energy on targets in FY 1988-1989. KMS Fusion will participate in target fabrication and development, supplying a variety of targets for NOVA and OMEGA experiments. Direct-drive compression experiments of 100-200 times liquid density will be attempted on the OMEGA laser in FY 1988. The Naval Research Laboratory will continue studies in both the glass and gas laser programs.

PRODUCTION AND SURVEILLANCE

OVERVIEW

The Weapons Production and Surveillance Program supports the fabrication and assembly of nuclear weapons and weapon components, and stockpile maintenance and reliability assessment. Production and Surveillance activities are supported by a decentralized, nationwide complex of government-owned, contractor-operated facilities.

Our FY 1989 budget request of $2.3 billion supports the production, stockpile improvement, and stockpile surveillance activities for a wide range of warhead and bomb programs essential to the national defense interests (Chart 9).

WEAPON BUILDS/DELIVERIES AND STOCKPILE IMPROVEMENT

In FY 1987, the DOE weapons production complex completed all of the required production milestones, an accomplishment for which we are extremely proud. Deleted new warheads were produced and delivered to DOD for deployment. End-of-production was achieved for the W76 TRIDENT warhead for the submarine-launched missile force. For FY 1988, we have achieved end-of-production on the W84 warheads for the ground-launched cruise missile program dependent on the acceptance and ratification of the treaty on intermediate range nuclear forces. Production continued throughout FY 1987, and will continue through FY 1988, on the B61 tactical bomb system, the B83 strategic bomb system, and the W80 submarine and air-launched cruise missile warheads. Initial production was accomplished for the W87 PEACEKEEPER warhead system which led to an Initial Operational Capability for this extremely important system in December of 1986. The introduction of the W87 warhead system into the war reserve stockpile was, we believe, a particularly noteworthy achievement exemplifying the finest cooperation between the DOE laboratories, production facilities, the DOD, and the Congress in executing a fast-track warhead development program designed to meet a critical national defense mandate. Two (2) new warheads progressed on schedule in the production engineering phase of development, the W88 Trident II warhead, and the W82 155mm artillery-fired projectile.

In FY 1987, considerable effort was also devoted to the upgrade of the reliability and safety of the existing stockpile with the continuation of the B61-1 strategic bomb upgrade and the completion of the W31 NIKE HERCULES warhead upgrade program. Delete

Deleted We continue to believe that a substantial continuing investment in continued stockpile reliability and safety is absolutely essential to our mission and should not be subserved to any other aspect of our program. In FY 1988, we expected to transition three (3) additional warheads into the design engineering phase of development -- the Small Intercontinental Ballistic Missile (SICBM) warhead, the Short-Range Attack Missile II warhead, and the nuclear depth/strike bomb (NDSB). However, the SICBM warhead is no longer supported in the FY 1989 workload.

Although the total new production requirements (Chart 10) in FY 1989 are lower in terms of units produced than in the past several years, this is expected to be only a temporary effect *Deleted* The unit production ebb in FY 1988 and 1989 is due mainly to the reductions taken in our FY 1986 budget to comply with the Balanced Budget and Emergency Deficit Control Act of 1985 and, to some degree, revised military requirements. However, the FY 1989 production level in terms of equivalent workload when normalized to the level of effort required due to varying production complexity factors and the adjustment for procurement lead-time, is greater than the actual FY 1987 level.

Our FY 1989 budget request supports (Chart 11) the continuing build of B61-3/4 tactical bombs, the B83 strategic bomb, the W80 warhead systems for the submarine and air-launched cruise missiles, and the W87 PEACEKEEPER warhead. Production of warheads for the first 50 silo-deployed PEACEKEEPER missiles will end in FY 1989. In FY 1989, we will begin (Chart 12) quantity production of the W88 warhead for the TRIDENT II system and continue to retrofit the B61 strategic bombs. Consistent with direction from the Nuclear Weapons Council, our FY 1989 budget does not support the continuation of the SICBM program.

During FY 1989, we also will be pursuing pre-production activities that will lead to the introduction of four extremely important warhead/bomb programs *Deleted* *Deleted* These include the Short-Range Attack Missile II, the

155mm artillery fired atomic projectile, a modern nuclear depth strike bomb, and additional stockpile improvements to the B61 bomb stockpile. These systems not only will provide improved operational effectiveness, but also continue our efforts to provide a safer and more secure nuclear weapons stockpile. Several weapons systems may be pursued in the future following congressional approval. These weapon systems involve the Rail-Based Peacekeeper, Follow-on to Lance, and the Antisubmarine Warfare Standoff Weapon.

We believe that it is essential that DOE's production complex be in the strongest possible position to meet the DOD workload requirements in the 1990s. This cannot be assured unless we make the appropriate prudent investments in FY 1989 to procure materials and tooling and accomplish the necessary facility construction and upgrades that are essential in meeting currently projected demands.

Through the formulation of the Nuclear Weapons Stockpile Memorandum, the Departments of Defense and Energy worked closely together to develop a fiscally responsive, integrated, and realistic nuclear weapons development and production strategy for meeting our envisioned national security needs. Our FY 1989 budget request supports the resources necessary to assure that the Nation maintains the necessary nuclear weapons production capability base to meet future weapons production requirements.

STOCKPILE MAINTENANCE

A total of 27 systems were maintained in the stockpile for FY 1987, *Deleted* *Deleted* These activities include retrofits, modifications, repairs, limited life component exchanges, retirements (Chart 13), and evaluation activities, including stockpile laboratory and flight tests. These activities, along with reliability assessments conducted throughout the year on a continuing basis, assure that the Nation's nuclear stockpile continues to remain safe, secure, and ready to provide nuclear deterrence.

In FY 1988, we will be maintaining about *Deleted* weapons comprised of 26 systems. The W53 TITAN II ICBM warhead was retired from the stockpile in FY 1987.

FY 1989 maintenance activities will be about the same as FY 1988, with the increase in funding, as for FY 1988, mainly attributed to the W76 TRIDENT warhead and the W68 POSEIDON warhead factory limited life component exchanges. Stockpiled systems will remain at twenty-six (26) with the retirement from the (inactive reserve) stockpile of the W71 SPARTAN surface-to-air missile warhead *Deleted* and the introduction of the W88 Trident II warhead, as indicated previously, in FY 1989.

PROCESS DEVELOPMENT

In order to assure we can accomplish the missions and programs of tomorrow, we need to prepare today. The Process Development program allows our production plants to achieve the successful introduction of new warhead programs (Weapon System Development), the improvement of production plant processes and operations (Manufacturing Development), and the initial scoping of new processes and techniques in evaluation of new weapon system concepts (Advanced Development). Frequently, productivity enhancements in manufacturing processes realized through Process Development translate into substantial outyear cost avoidances on new warhead programs.

In light of the restrictive budget we are facing, we have proposed some real reduction in funding, when accounting for escalation, in our FY 1989 request. With the three new weapon systems (Short-Range Attack Missile II, nuclear depth strike bomb, and W82 artillery fired atomic projectile) anticipated to be entering or in pre-production phase activities in FY 1989, development endeavors will be straining to support the successful introduction of these programs into production and the stockpile.

MANUFACTURING SUPPORT

Quality receives major emphasis in the production of nuclear weapons. Excellent quality is our goal in assuring that the production complex operates safely and efficiently, and that the systems and components produced are safe, effective, reliable, and can withstand the anticipated stockpile environments. To further our goal of excellence in quality and productivity, a new Quality Assurance Program was developed and initial implementation of a phased transition was completed in FY 1987. This plan is oriented toward the philosophy of eliminating the manufacture of defective product by improving the production processes and controls, as opposed to the previous quality philosophy that was directed to inspection and detection of defective product after manufacture. This approach is already showing results throughout the complex. The number of DOE in-plant inspectors has been reduced by 20 percent in the past two years, and scrap and rework activities are decreasing. Overall product quality and productivity is improving. Given the anticipated continuation of the tight fiscal climate, our productivity must continue to improve if we are to continue to meet our national security requirements on a timely basis with quality product.

Computer integrated manufacturing and design activities continue to improve our productivity. We have completed a wideband communications network between all nuclear weapon complex sites. This network facilitates the rapid, and accurate, transmission and review of weapons programs, designs, and plant information. The design for the W88 TRIDENT II warhead, which will enter quantity production in FY 1989, was accomplished in its entirety in the computer-aided environment, and more than 50 percent of the manufacturing activities in the production plants will be using computer integrated manufacturing processes.

The Department is pursuing a number of endeavors to help assure our facilities are sufficient to meet our responsibilities to DOD and the Nation. We believe it prudent and necessary to build and modify facilities and invest for the future. Our construction and modification plans and projects are directed to provide capability and capacity to serve for the remainder of this century, and beyond, providing the basis for new designs and endeavors.

In manufacturing, we will continue with the High Explosives Machining Facility project at the Pantex Plant. This $60 million project will provide assurance for the continued and uninterrupted machining capability of high explosives for nuclear weapons. Additionally, risk to personnel during the machining of high explosives will be reduced.

Another of the projects under construction in FY 1988 and FY 1989 is the Tritium Loading Facility Replacement at Savannah River, scheduled to be completed in FY 1990. Through support of the Congress and the Administration, this $120 million project will replace poor and inadequate tritium reservoir loading facilities needed to support the nuclear weapons production schedule and stockpile maintenance in FY 1990 and beyond.

Special Nuclear Materials and their timely availability and adequate supplies is an area of increasing concern to the Department and the Nation. Chernobyl has placed nuclear policies, practices, and facilities under the national spotlight. It is well known that DOE's existing facilities are dated, and with the evolution of new evaluation criteria and techniques, compliance with new safety and environmental regulations is often difficult and many times not possible. Investigative actions and new safety requirement implementation have reduced the DOE's ability to produce plutonium and tritium. These materials are vital for weapons production and stockpile maintenance. Nonetheless, safety is paramount. Upgrades to accommodate environmental, safety, and health concerns have been identified and are being implemented. This continuing competition for funding has not been without programmatic impact. The plutonium supply/demand situation is now at a critical stage. Plutonium is supplied for new production at the Rocky Flats Plant (Chart 14) from three sources: (1) new production from the Savannah River Plant, (2) recovery of plutonium from retired weapons, and (3) from residue recovery at Rocky Flats, LANL, Savannah River, and Richland. All these supplies added together are necessary and critical to meet production commitments. Each of our plutonium facilities and plants, even with the perturbations experienced in the past few years, is required (Chart 15).

To enhance our nuclear materials position, and reduce the effects of unforeseen incidents and restrictions, we are attempting to enhance our plutonium recovery efforts to provide additional plutonium from scrap backlogs. This will require a coordinated plan of financial investment and processing capability expansion. Plutonium recovery is a cost-effective method of providing plutonium for production activities, which is supplemented by the production reactors. Enhancing our plutonium recovery will aid in the Deleted reducing stockpiled residues and attendant waste management considerations while lessening the risks from new plutonium supply interruption.

The plutonium recovery facilities in Buildings 771 and 776 at Rocky Flats, as currently configured, do not adequately support the long-term posture required to maintain the basic recovery mission for weapons production activities. The Plant's original plutonium facility, Building 771, continues to maintain its role of recovery in the nuclear weapons production complex. Building 771 is old; its equipment is wearing out, and maintenance and repair activities are necessary daily to keep it running. Built in 1953, it doesn't meet all of today's structural criteria, and is incapable of operating under revised safeguards standards. Building 776's mission is directed principally to the processing of plutonium from retired weapons, a very important mission to support new production activities. Built in 1957, it is also old and does not meet today's structural criteria. Radiation exposures to operating personnel are higher than desirable in this facility, due to the nature of the material processed (aged plutonium has a natural ingrowth of americium-241, an active gamma radiation emmiter). Although exposure does not exceed allowable limits, the Department would like to reduce these doses in consonance with our safety criteria (ALARA).

Building 371, built as a replacement to the aged plutonium facilities, failed to operate as intended and requires extensive modification. Building 371 is a fully hardened facility and is capable of meeting all current environment, safety and health, and safeguards and security criteria. As a result, it is the Department's best technical and management judgement that Building 371 should be modified as a replacement for the plutonium recovery operations in Buildings 771 and 776. Numerous studies have shown this course of action to be the most logical, most cost effective, and most desirable of all practical alternatives. The Plutonium Recovery Modification Project has a total estimated cost of $371 million.

Enriched uranium is another nuclear material which has an important role in the production of new weapons. Like plutonium, it too is recycled and recovered from manufacturing residues and retired weapons. Recycle and recovery is currently the source of uranium for new weapons production. No new enriched uranium has been bought from the enrichment plants for the weapons program since 1964. To assure the continued success of uranium recovery activities, the Department has pursued the Enriched Uranium Recovery Improvements Project since 1985. This $51 million project will be completed in FY 1989.

MAINTAINING THE WEAPONS COMPLEX

The Department of Energy is responsible for the production and lifetime surveillance of safe and reliable nuclear weapons in support of the U.S. national security. To accomplish this mission the research, development and testing complex and the weapons production complex have a unique set of facilities.

As is depicted in this chart (Chart 16), almost 50 percent of the entire weapons complex now in use is more than 30 years old. The building ages are also indicative of the utility systems' ages. For most buildings with normal maintenance, 30-40 years' age is when either major rehabilitation or replacement needs to be initiated. In addition to normal deterioration the nuclear weapons complex is being impacted by outdated technology.

Aging and the resultant fragility is an ongoing problem. Quick fixes are not the solution. A long-term strategy to assure sustained capability was developed. This chart (Chart 17) depicts our past and present strategy for assuring the viability of the weapons complex. Equipment and general plant project levels are the absolute minimum required to sustain the foundation. We are requesting in FY 1989 $55.7 million for general plant projects and $272.3 million for capital equipment. The capital equipment request is increasing 3 percent over FY 1988 appropriation, about the increase anticipated for inflation.

ACCOMPLISHMENTS

We have successfully completed 12 of the 22 subprojects that constitute the FY 1984 and FY 1985 Revitalization projects. We anticipate successful completion of 5 more subprojects this year. Some of the benefits provided to the weapons research, development and testing complex include: upgrade of x-ray characterization capabilities; support for larger diameter canisters Deleted power system upgrade to replace deteriorated underground systems; and upgrade of test site support facilities.

Our Restoration program which is coming to its conclusion met its objective of replacing the most deteriorated utilities and equipment to assure workload delivery schedules were achieved. Some specific examples of improvements made under Restoration include the retrofitting of a 1500 ton press. The press (Chart 18) used in many forming operations for production weapons components had little control of the pressing parameters. After retrofitting the press shown here (Chart 19), affords improved productivity due to the ability to program, adjust, and control pressing parameters.

Another accomplishment under the Restoration Program was the improvements to the centralized chilled water and brine system at the Y-12 Plant. Six additional central chilled areas were installed to provide the required cooling needed for production and support loads. This significantly improved the reliability, availability, and maintainability of the system while reducing maintenance and operating costs. The Chart (Chart 20) depicts one of the chillers replaced that ranged from 30-45 years old. Here is (Chart 21) one of the eight new chillers installed. These are just some of the many accomplishments under the Restoration Program.

FACILITIES CAPABILITY ASSURANCE PROGRAM

While not a new start, the importance of the ongoing Facilities Capability Assurance Program should be reemphasized. This program is designed to identify, manage, and correct long-term facilities deficiencies within a specified annual funding ceiling. We are requesting $79 million in FY 1989 to continue this critical program.

The production complex consists of more than 14.5 million square feet of building with over 70 miles of roads and 171 miles of fencing on more than 20,000 acres of land having a total estimated value in excess of $8.3 billion excluding capital equipment. More than 55 percent of the facilities were constructed in the 1940s and 1950s. Many of these facilities have reached or exceeded their reasonable life expectancy, are in poor condition, and/or functionally inadequate to meet modern weapons production requirements.

The Facilities Capability Assurance Program utilizes a documented, auditable appraisal program to identify poor physical conditions, functional inadequacy, and capacity and capability problems of facilities and utilities to meet current production complex program requirements.

REVITALIZATION

We are requesting no new construction projects other than the normal general plant project for research, development and testing. However, we would like to request your continued support for the ongoing Revitalization Program. Revitalization is the research, development and testing counterpart to production's Facility Capability Assurance Program. We are requesting $79 million to continue our FY 1988 revitalization project and provide the final year funding for the FY 1985 revitalization project.

Nuclear weapons research, development and testing requires highly specialized facilities to achieve progrmmatic goals. A decade of decline in the 1970s of advanced research, development and testing effort and minimal construction funding for the weapons research, development and testing complex created a backlog of critically needed facilities to replace aged facilities and to provide facilities which meet the technological need and standards for the mission of the 1980s and beyond. The research, development and testing complex covers 18 million square feet of facilities with an estimated replacement value of $7 billion. As seen in these charts (Chart 22A & B) we are requesting $105 million to continue ongoing programmatic construction to include the FY 1988 Revitalization Project.

ENVIRONMENT, SAFETY AND HEALTH

OVERVIEW

Over the past several years the Secretary has established initiatives to assure that the Department is operating its facilities safely, in an environmentally acceptable manner, and in compliance with the intent and spirit of applicable laws. There are two major thrusts to this program: to assure that the nuclear facilities are operated at a level of safety comparable to the privately licensed nuclear sector; and, to bring all the Department's facilities into compliance with environmental laws.

ACCOMPLISHMENTS

NUCLEAR SAFETY

During the past year there has been a major effort to improve the radiation protection programs at various plants in the weapons complex. This has been in the form of increased staffing and the initiation of construction of new facilities to improve the calibration of radiation instruments used in monitoring workers and to assure that contamination is not inadvertently tracked out of the plant. Construction of these facilities has started at our Rocky Flats, Y-12, and Pantex Plants. Safety Analysis Reports, comparable to Nuclear Regulatory Commission licensing reviews, were completed for the major plutonium operations buildings at Rocky Flats. We have made structural upgrades to class one plutonium handling buildings at the Rocky Flats complex. The upgrades to the buildings have significantly improved the safety status of the buildings.

ENVIRONMENTAL PROTECTION

Compliance with environmental laws remains a major issue in the weapons complex. Generally, compliance is not a matter of meeting specific standards. Rather, it involves a permitting process where the regulatory agency reviews a proposed action and either agrees with it or requires additional efforts. Over the past several years this process has been initiated at almost all the weapons complex sites. The Department's Rocky Flats Plant has a General Agreement in place with the Environmental Protection Agency and Colorado and is working on a detailed permit under the Resource, Conservation, and Recovery Act (RCRA) for the treatment and storage of hazardous and mixed wastes. Additionally, the Nevada Test Site has received interim approval for the storage of mixed waste and is negotiating for a permanent permit for disposal. Also, a permit to begin construction of the Tritium Loading Facility was issued by the Environmental Protection Agency under the radionuclide emission regulations of the Clean Air Act.

All sites have made substantial progress in conducting the assessments required by the Superfund Amendments and Reauthorization Act. All weapons complex sites were identified to the Environmental Protection Agency and are included in the Federal Docket which was mandated by the Superfund Amendments and Reauthorization Act. Because of the organics discovered in the groundwater, Livermore has been identified as a National Priority List candidate, and it is anticipated the other sites such as Y-12 and Rocky Flats may be placed in that category.

During FY 1988, major environmental improvements were completed at several of our sites. At the Y-12 Plant, a closed-loop cooling system to stop the discharge of plant process water to the storage drainage system was installed. Upgraded sewer lines and surface drainage deficiencies to prevent movement of soil surface contamination. Improvements to the air and water pollution systems were also completed to decrease mercury contamination in surface runoff and stream discharges. At our Kansas City Plant, a hazardous chemical storage system was constructed, and PCB-contaminated soils removed and the the waste water treatment facility was replaced. Additionally, the electrical equipment containing PCBs was replaced at several weapons complex sites.

MANAGEMENT INITIATIVES

Several management initiatives have been taken to make sure that nuclear safety improvements and compliance with environmental law is accomplished in a timely but cost effective manner. A decision by the Assistant Secretary for Defense Programs established a central office to budget for and manage an Environmental Restoration Program. This office will establish priorities, justify funding, and provide management for necessary remedial actions at all inactive waste sites subject to the Comprehensive Environmental Response, Compensation, and Liability Act, and certain active waste sites which are subject to the Resource, Conservation, and Recovery Act, thereby, relieving the line program offices from having to duplicate these functions.

A long-range environmental safety and health (ES&H) planning system has been developed and implemented. An annual Environmental Safety and Health Program Review has been instituted as a mechanism to bring environmental safety and health managers from the DOE contractors and Headquarters and field operations together to identify cost effective corrective actions to environmental and safety concerns. This review brought together all levels of management within DOE to affect enhancements in this most important area.

As part of his new initiatives, the Secretary has established independent reviews of plant operations in Environmental Surveys, and Technical Safety Appraisals. The weapons complex is developing a system for field and

Headquarters so that a fast action response to the Surveys and Appraisals can be provided, and the needed actions can be incorporated into the long-range planning or the next year's budget process. The weapons complex is also responding to outside independent reviews such as reviews by the National Academy of Sciences mandated by P.L. 100-180.

FY 1989 PROGRAM

Our FY 1989 Budget estimate related to environmental safety and health matters is approximately $252 million for the weapons program. In FY 1988 approximately $232 million is projected.

The base Environmental Safety and Health Program will continue at all plants in FY 1989 with the object of protecting the health and safety of the public and plant workers, protecting government property against damage by fire or accident, protecting the environment, and complying with applicable environment, safety, and health laws. The National Academy of Sciences will conduct a review of the weapons complex to determine the safety of our sites and the environmental impact of our operations. This will require efforts to collect and assess data for the reviewers. Increased efforts will be mounted in nuclear safety, particularly with respect to occupational radiation protection and quality assurance. Extra work will continue in environmental protection to keep moving the weapons complex towards compliance with environmental laws. Most assessments will be completed and it is expected that these will indicate the need for greater and improved monitoring to assure compliance with the Resource, Conservation, and Recovery Act and the Clean Air Act. This will mean more groundwater wells, double lined disposal pits, and improved stack samplers and monitors. National Environmental Policy Act (NEPA) assessments will be completed for several facilities including the Decontamination and Waste Treatment Facility at Livermore, Building 371 at Rocky Flats, SDI facilities at various locations, and waste incinerators at various locations. Finally, a major campaign will be initiated to develop waste reduction techniques.

SAFEGUARDS AND SECURITY

ACCOMPLISHMENTS

We have continued to operate the weapons production complex in a secure manner. Even though there have been many demonstrations at our sites and much harassment of our courier force, there have been no significant security events. We have made significant progress in improving our protection of facilities, completing several major upgrade projects. Master Safeguards and Security Agreements with our key facilities have been signed or will be in the next few months. We have actively participated in the development of new and revised safeguards and security requirements, standards, and criteria. Our long-range security plan, which helps guide the weapons complex into the future has been updated and provided to the field activities.

FY 1989 PROGRAM

Included in our FY 1989 estimate is $396 million for Safeguards and Security. With these funds, we intend to maintain our excellent record of operating without any significant security incidents and we will continue to upgrade the security posture of our facilities. We will focus our efforts to complete Master Safeguards and Security Agreements with every facility and improve our program to counter the insider threat. I have initiated and will continue a program to analyze the Master Safeguards and Security Agreements and inspection reports for the purpose of improving our understanding of key, common security concerns and identifying effective solutions to difficult security problems. Through periodic security program reviews with the operations offices, I want to share these problems and solutions.

PROGRAM DIRECTION

The Weapons Program Direction budget request of $81.4 million (Chart 23) provides for Federal program direction and oversight of the Weapons and other Defense Programs activities at Headquarters, and at the Albuquerque and Nevada Operations Offices. The budget request provides for an increase of ten full-time Federal employees, for a total of 861 in fiscal year 1989. This activity also contains funding for contractual services and for the Community Assistance Program at Los Alamos, New Mexico.

7. SUMMARY

In summary, our request responds to the most critical national security requirements within the fiscal constraints agreed to by the Congress and the Administration in the recent budget summit. There are a number of national defense policy issues that both the Administration and Congress must respond to. In any event, for the foreseeable future nuclear deterrence will remain a cornerstone of our national defense strategy and a vital DOE weapons program will remain essential.

In closing, I would like to thank you for your strong support through the years and look forward to working with you this year and in the future.

CHART 1

SUMMARY TABLE (DOLLARS IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROPRIATION	FY 1989 REQUEST
RESEARCH AND DEVELOPMENT	$1,226.8	$1,305.3	$1,323.2
TESTING	618.7	599.6	591.1
PRODUCTION AND SURVEILLANCE	2,247.4	2,227.7	2,261.2
PROGRAM DIRECTION	70.0	74.8	81.4
TOTAL WEAPONS ACTIVITIES	$4,162.9	$4,207.4	$4,256.9

CHART 2

RESEARCH, DEVELOPMENT, AND TESTING-CORE PROGRAM (DOLLARS IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROPRIATION	FY 1989 REQUEST
OPERATING EXPENSES	$1,126.5	$1,165.6	$1,169.0
CAPITAL EQUIPMENT	119.8	124.1	127.9
CONSTRUCTION	130.7	177.2	168.6
TOTAL, CORE PROGRAM	$1377.0	$1,466.9	$1,465.5

CHART 3

NUCLEAR DIRECTED ENERGY WEAPONS (DOLLARS IN MILLIONS)

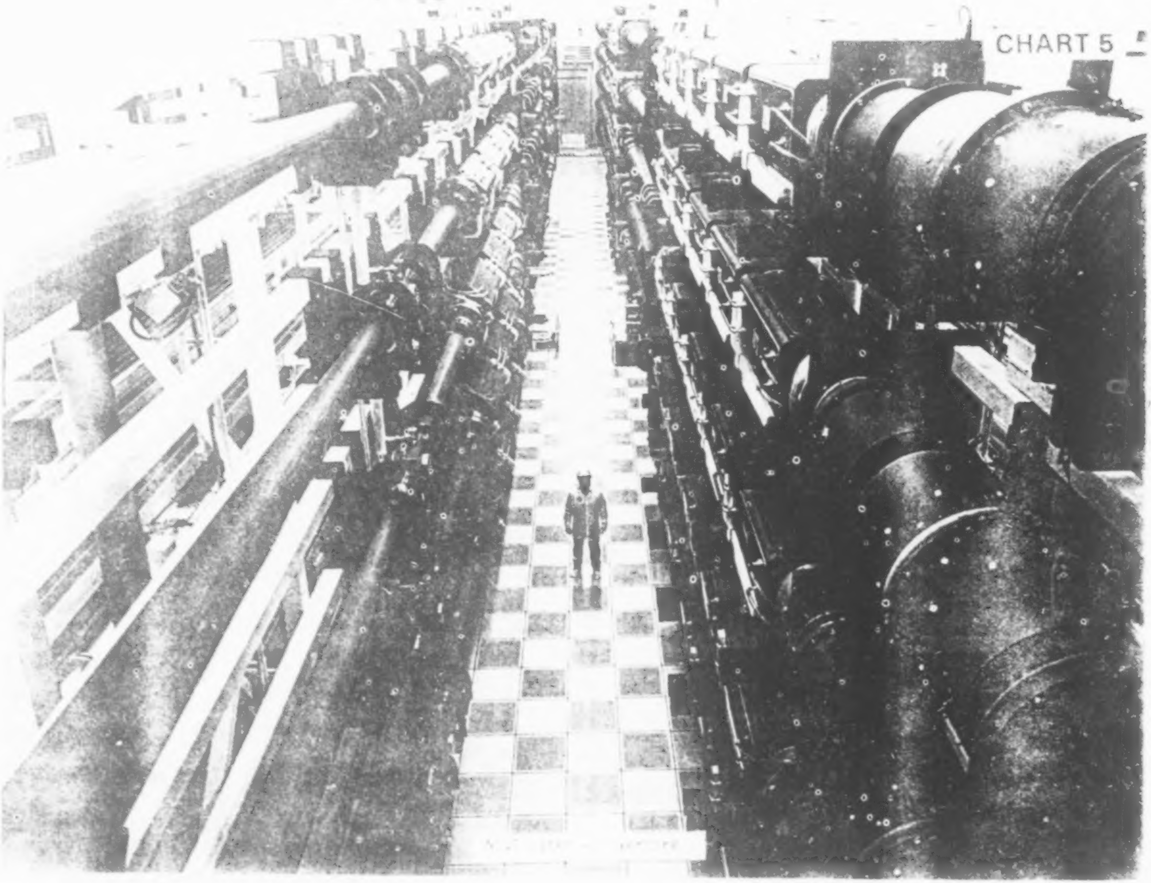
	FY 1987 ACTUAL	FY 1988 APPROPRIATION	FY 1989 REQUEST
OPERATING EXPENSE	$270.0	$240.0	$252.2
CAPITAL EQUIPMENT	32.2	17.0	17.5
CONSTRUCTION	14.8	22.0	15.3
TOTAL, NDEW	$317.0	$279.0	$285.0

CHART 4

RESEARCH, DEVELOPMENT, AND TESTING-INERTIAL FUSION (DOLLARS IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROPRIATION	FY 1989 REQUEST
OPERATING EXPENSES	$142.7	$151.0	$155.5
CAPITAL EQUIPMENT	8.9	8.0	8.3
TOTAL, INERTIAL FUSION	$151.6	$159.0	$163.8

CHART 5



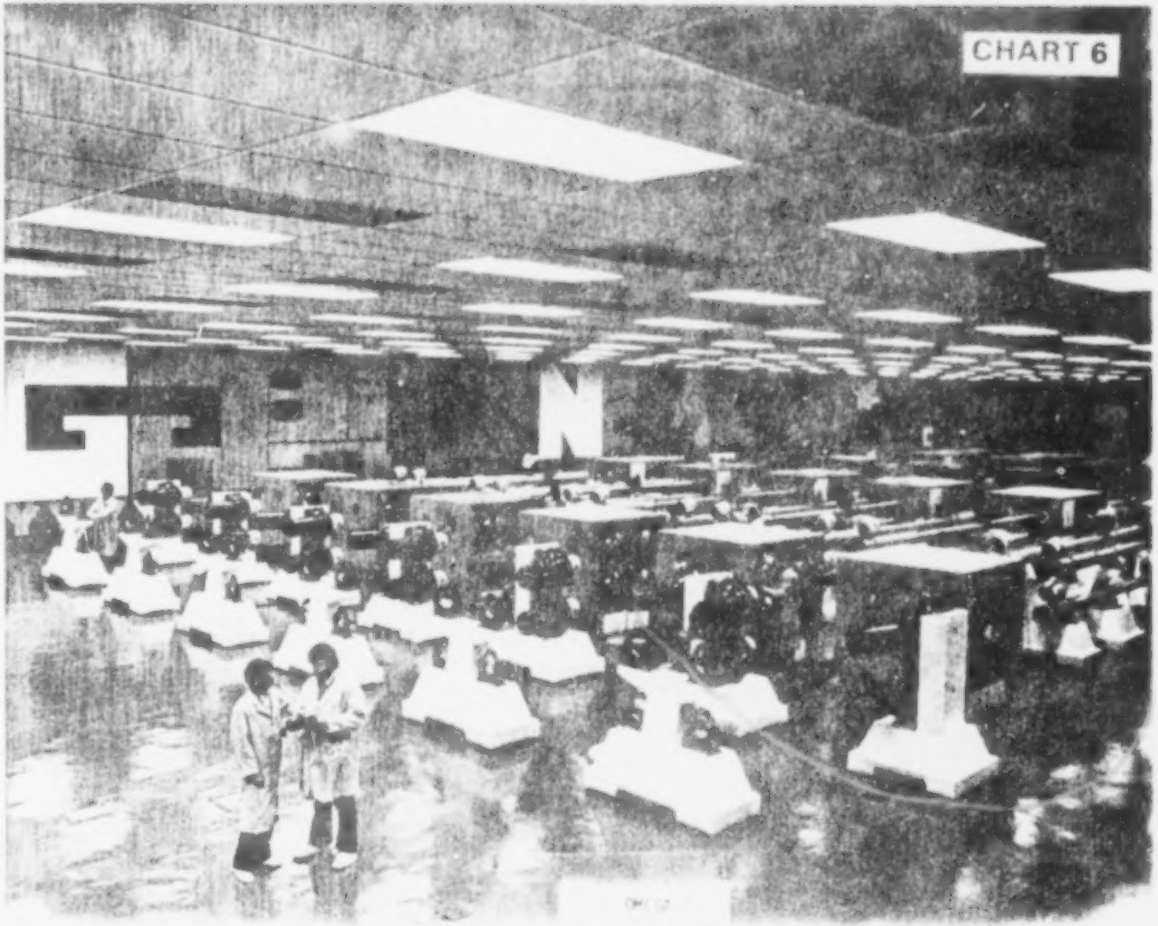
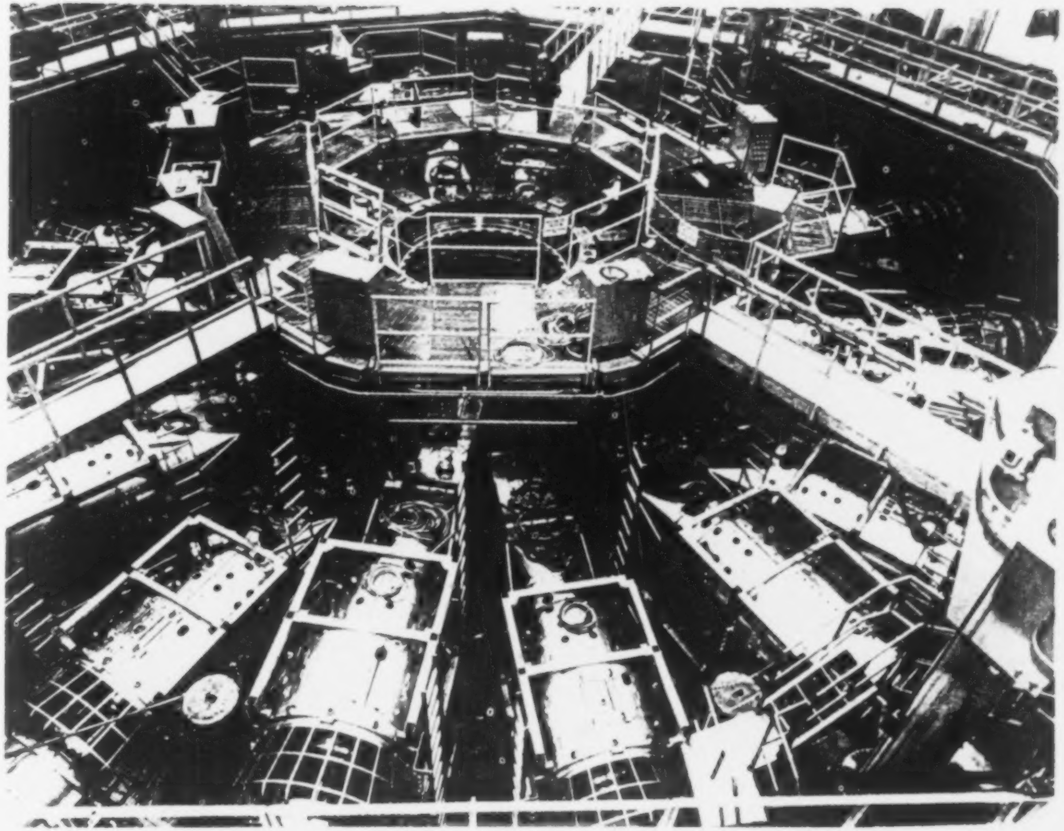


CHART 6

CHART 7



PBFA II - Sandia

CHART 8

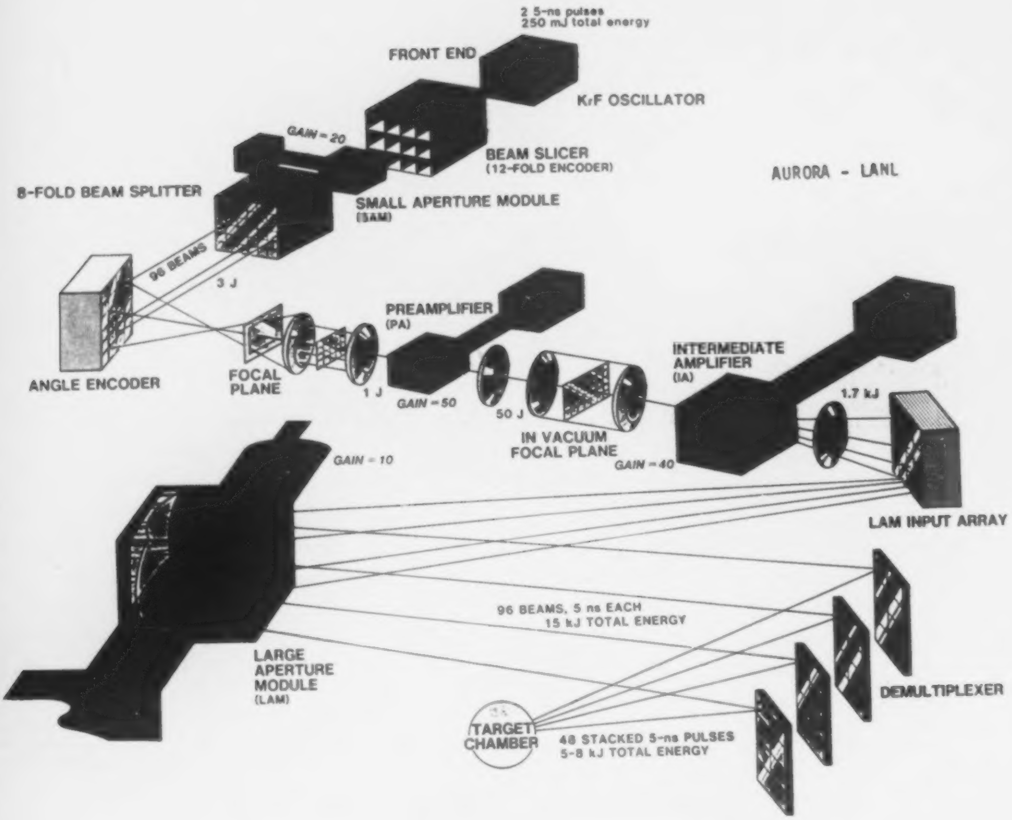

2 5-ns pulses
250 mJ total energy
FRONT END
KrF OSCILLATOR
GAIN = 20
BEAM SLICER
(12-FOLD ENCODER)
AURORA - LANL
8-FOLD BEAM SPLITTER
SMALL APERTURE MODULE
(SAM)
96 BEAMS
3 J
PREAMPLIFIER
(PA)
ANGLE ENCODER
FOCAL
PLANE
1 J
GAIN = 50
50 J
IN VACUUM
FOCAL PLANE
INTERMEDIATE
AMPLIFIER
(IA)
1.7 kJ
GAIN = 40
GAIN = 10
LAM INPUT ARRAY
96 BEAMS, 5 ns EACH
15 kJ TOTAL ENERGY
LARGE
APERTURE
MODULE
(LAM)
DEMULTIPLEXER
TARGET
CHAMBER
48 STACKED 5-ns PULSES
5-8 kJ TOTAL ENERGY

CHART 9

PRODUCTION AND SURVEILLANCE (DOLLARS IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROPRIATION	FY 1989 REQUEST
OPERATING EXPENSES	$1,799.6	$1,853.7	$1,909.4
CAPITAL EQUIPMENT	121.4	115.1	118.6
CONSTRUCTION	326.4	258.9	233.2
TOTAL P&S	$2,247.4	$2,227.7	$2,261.2

CHART 10

(Deleted)

CHART 11

PROGRAMS SUPPORTED

(Continuing Builds)

- ✓MODERN TACTICAL BOMBS (B61-3/4)
- ✓CRUISE MISSILE WARHEADS (W80s)
- ✓MODERN STRATEGIC BOMB (B83)
- ✓SILO-BASED PEACEKEEPER (W87)
- ✓STOCKPILE MODERNIZATION (B61)

CHART 12

PROGRAMS SUPPORTED

(New Production)

- ✓TRIDENT II (W88)
- ✓MODERN ARTILLERY PROJECTILE (W82)
- ✓SRAM II (W89)
- ✓NUCLEAR DEPTH/ STRIKE BOMB
- ✓RAIL-BASED PEACEKEEPER (W87) *
- ✓FOLLOW-ON TO LANCE *
- ✓ASW/SOW *

** FOR PLANNING ONLY*

CHART 13

(Deleted)

CHART 14

(Deleted)

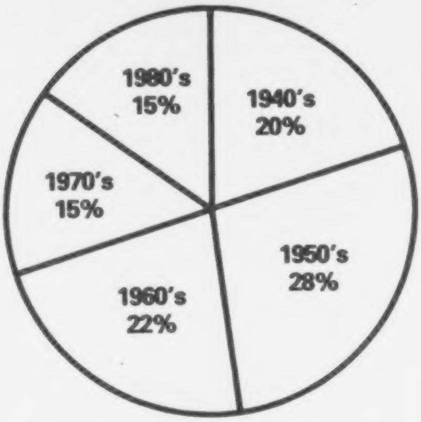
CHART 15

(Deleted)

CHART 16

CONSTRUCTION DATES OF NUCLEAR WEAPONS COMPLEX

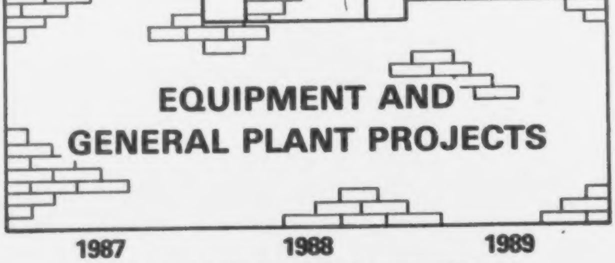
(33 MILLION SQUARE FEET)



EST REPLACEMENT VALUE
$15 + BILLION

CHART 17

CAPABILITY ASSURANCE STRATEGY



* FACILITIES CAPABILITY ASSURANCE PROGRAM

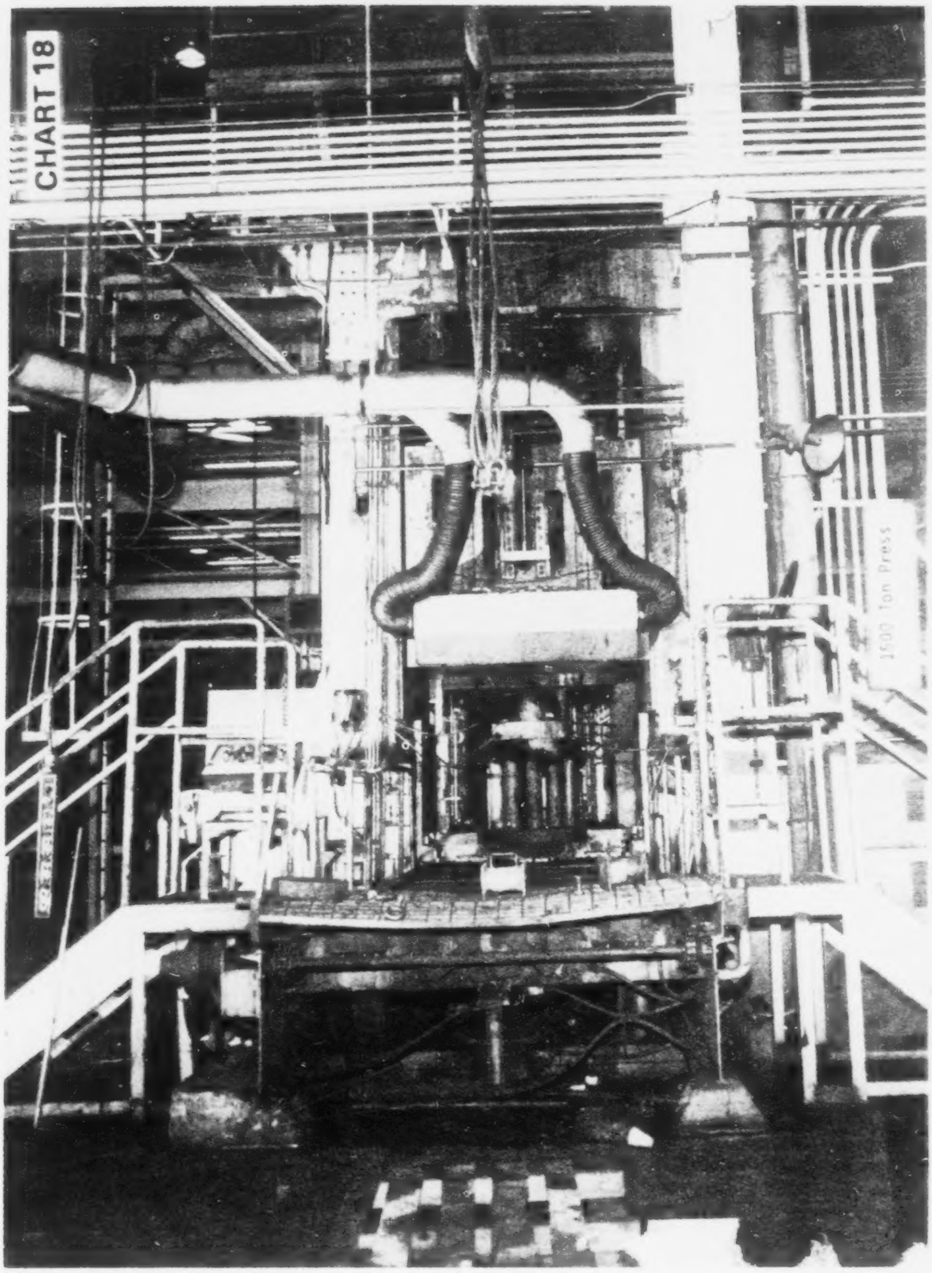


CHART 18

1500 Ton Press

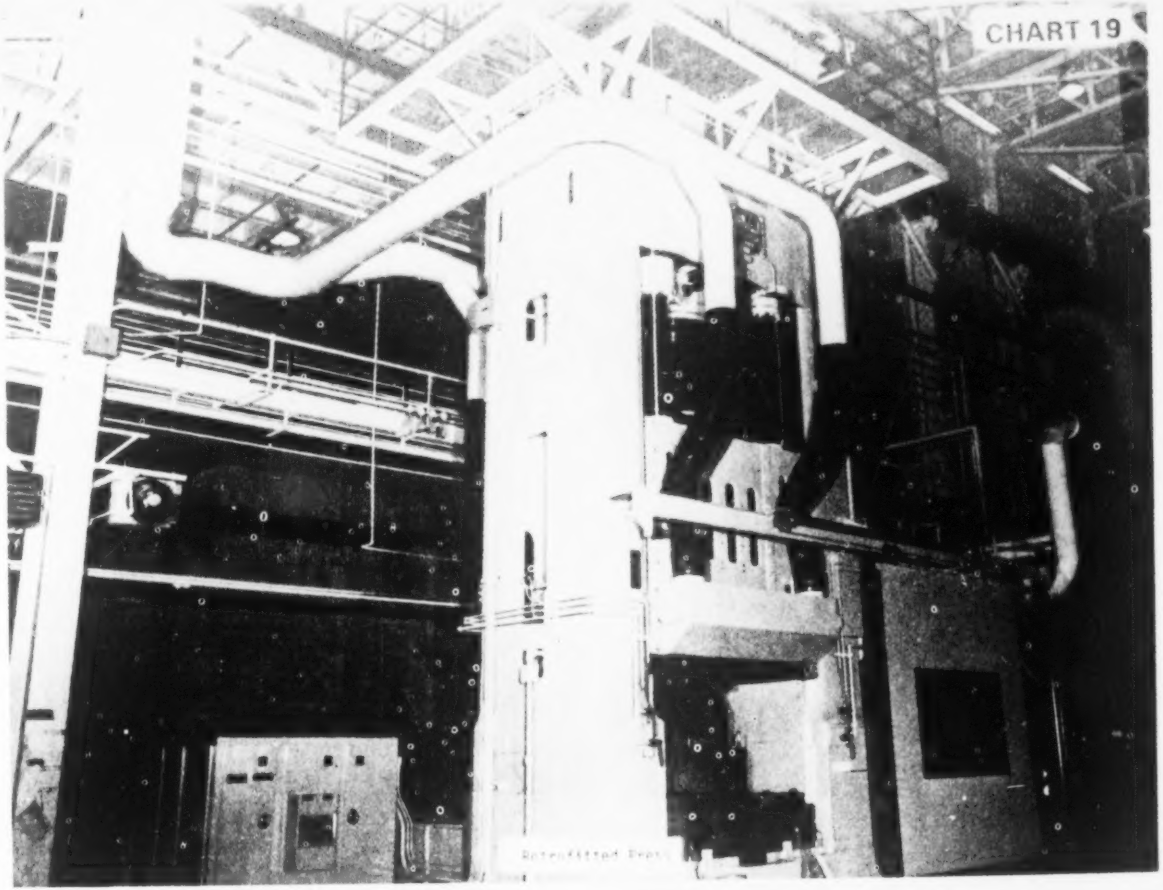


CHART 19

Retrofitted Press

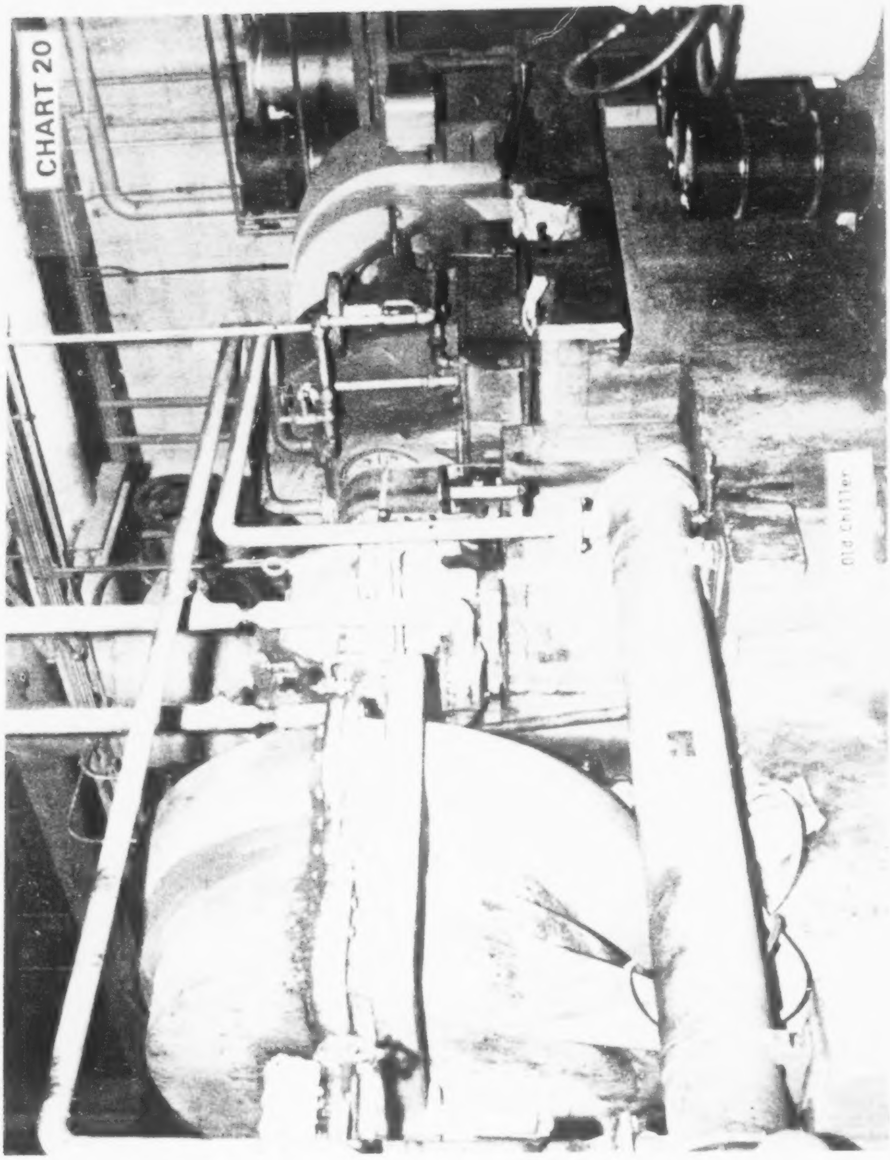


CHART 20

Old Chiller

CHART 21

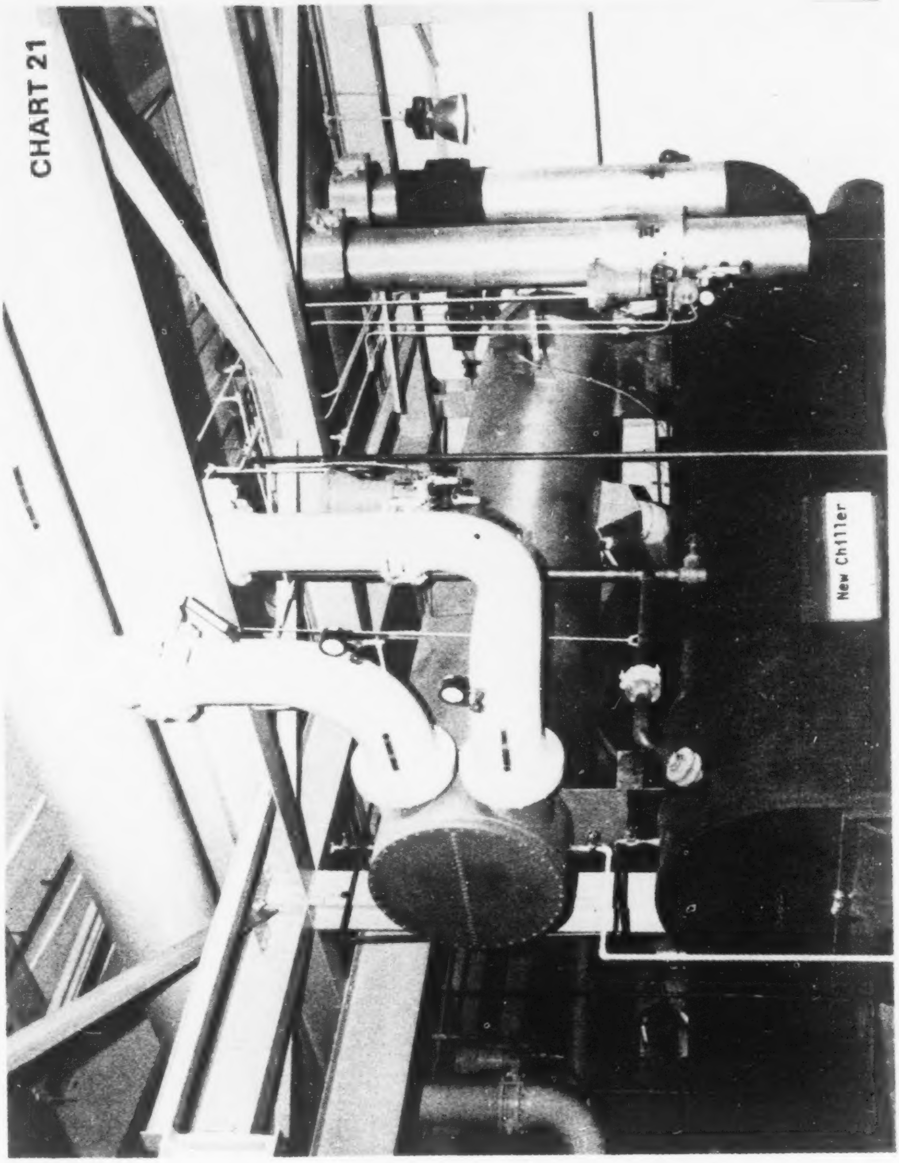

New Chiller

CHART 22A

RESEARCH, DEVELOPMENT, AND TESTING — PROGRAMMATIC PROJECTS

(DOLLARS IN MILLIONS)

PROJECTS		TEC	FY 1988 APPROPRIATION	FY 1989 REQUEST
88-D-105,	SPECIAL NUCLEAR MATERIALS R&D LABORATORY REPLACEMENT, LANL	$210.0	$10.0	$22.0
88-D-106,	REVITALIZATION, PHASE II, VARIOUS LOCATIONS	$317.3	$29.0	$72.4
88-D-104,	STRATEGIC DEFENSES FACILITY, SNLA	$ 70.0	$15.0	$ 3.2
86-D-105,	INSTRUMENTATION SYSTEMS LABORATORY, SNLA	$ 18.4	$ 8.0	$ 0.0
86-D-106,	LABORATORY DATA COMMUNICATIONS CENTER, LANL	$ 25.0	$12.2	$ 0.0

CHART 22B

RESEARCH, DEVELOPMENT, AND TESTING — PROGRAMMATIC PROJECTS (CONT'D)

(DOLLARS IN MILLIONS)

PROJECTS		TEC	FY 1988 APPROPRIATION	FY 1989 REQUEST
85-D-102,	REVITALIZATION, PHASE I, VARIOUS LOCATIONS	$156.5	$ 33.5	$ 6.8
84-D-107,	TESTING REVITALIZATION, VARIOUS LOCATIONS	$ 79.2	$ 5.5	$ 0.0
	TOTAL, RD&T PROJECTS		$113.2	$104.4

CHART 23

PROGRAM DIRECTION
(DOLLARS IN MILLIONS)

	FY 1987 ACTUAL	FY 1988 APPROPRIATION	FY 1989 REQUEST
PROGRAM DIRECTION	$70.0	$74.8	$81.4

- PROVIDES FOR 861 FEDERAL FTE'S ($47.2M)
- PROVIDES FOR NEEDED CONTRACTUAL SERVICES ($25.0M)
- SUPPORTS THE LOS ALAMOS COMMUNITY ASSISTANCE PROGRAM ($9.2M)

STATEMENT OF F. CHARLES GILBERT, DEPUTY ASSISTANT SECRETARY FOR DEFENSE PROGRAMS, DEPARTMENT OF ENERGY

INTRODUCTION

Mr. Chairman and members of the Committee, I am Dr. Charles Gilbert, Acting Deputy Assistant Secretary for Security Affairs (DASSA). It is a pleasure to appear before you today to address the Department of Energy's Security Affairs programs of Nuclear Safeguards and Security (including the Office of Classification), Security Investigations, and Verification and Control Technology, and our Fiscal Year (FY) 1989 budget request required to carry out these programs.

Although I have appeared before this Committee as a representative for other DOE key areas, this will be my first time as the Acting Deputy Assistant Secretary for Security Affairs. Prior to my tenure with DOE and its predecessor agencies, I worked in various capacities at the Lawrence Livermore Laboratory in California. Until my current assignment as acting DASSA, for the last 6 months I headed up an ad hoc Arms Control Working Group for the Assistant Secretary for Defense Programs. Prior to that I served as Director, Office of Classification; Director, Office of Security and Quality Assessments; and Deputy Assistant Secretary for Nuclear Materials after having been Director of Nuclear Materials Production; and I have also served as Deputy Director of the Office of Military Application.

Mr. Chairman, let me stop and say at this point that I intend to keep you informed on the activities of interest to your Committee in the Security Affairs area. Routinely, I will be communicating our program initiatives and areas of concern to you and the Committee staff. I will be pleased to meet with you, Committee members, or the Committee staff at anytime to discuss matters of interest.

SECURITY AFFAIRS

The Security Affairs programs that I will discuss with you today play an extremely critical role in fulfilling the Department's national security mission. We are keenly aware of the importance of our responsibilities in carrying out these programs. They are the Department's cornerstone in: preventing the theft or sabotage of nuclear weapons, materials, facilities, and compromise of classified information; developing and implementing policy for managing the classification and declassification of information; providing nuclear weapons systems expertise to the Intelligence Community; controlling proposed exports of nuclear materials technology and equipment; providing technology and equipment necessary to monitor treaty compliance of foreign nuclear weapons programs; and providing technical and analytical support for DOE's role in arms control negotiations, policy formulation, and implementation.

First let me mention the Verification and Control Technology (V&CT) program in the Office of International Security Affairs. The V&CT program has the overall goal of supporting the development and execution of U.S. national security and foreign policies in the areas of treaty verification, intelligence, arms control, and control of sensitive technologies as they pertain to the Department of Energy's responsibilities. Important initiatives include the Joint Verification Experiments and the verification of the provisions of the START treaty. A more detailed discussion of the V&CT program and major initiatives will take place later in the testimony, after the Nuclear Safeguards and Security section.

Although I have only been associated with the Security Affairs programs such as Nuclear Safeguards and Security, etc. for a short period of time, I have been impressed with the Office of Safeguards and Security's corporate commitment to an effective safeguards and security environment, which is demonstrated by DOE officials and DOE contractors. There continues to be outstanding support and commitment by our protective force, major nuclear facilities, as well as our research and development contractors.

FY 1989 BUDGET

Security Affairs requests $259.8 million for FY 1989, a net increase of 13 percent over FY 1988. This consists of $80.2 million for Nuclear Safeguards and Security (including $4.6 million for Classification); $40.0 million for

Security Investigations; and $139.6 million for Verification and Control Technology.

NUCLEAR SAFEGUARDS AND SECURITY

The Nuclear Safeguards and Security program has three major program goals:

- Prevent the theft, sabotage, or loss of nuclear weapons and their components, special nuclear materials, and facilities and the unauthorized disclosure of classified information.
- Provide a base of safeguards and security technology for the protection of Department of Energy facilities, nuclear weapons, materials, and classified information.
- Support international protection to deter the diversion of nuclear materials and to support nonproliferation and national security objectives.

INITIATIVES

I would like to briefly discuss the status of several initiatives the Department has undertaken to enhance our overall security posture, and which are in furtherance of these goals.

In our policy role, with the support of a Department-wide safeguards and security task force, we have been successful in updating almost all safeguards and security Departmental directives, including the incorporation of the Department's Inspection Standards and Criteria. It is expected that all revised directives will be published in March/April 1988. This effort strengthens our overall policy role, and helps to ensure consistency of implementation throughout our facilities.

Corporate Planning and Programming

Effective safeguards and security planning is a cornerstone in the development of cost effective and appropriate protection measures for the Department's assets. OSS has developed a corporate safeguards and security planning approach that considers long-term programmatic requirements and trends, identifies strategic policy issues affecting the outyears, and identifies action that must be taken to address concerns and vulnerabilities. During the last year, a Five-Year Plan was developed providing a forward look at major policy initiatives under development and the focus of future policy direction. It is from baseline planning direction such as the Five-Year Plan that field offices may better develop their individual safeguards and security planning documents and resulting budget needs. The development of forward-looking plans both at Headquarters and at our operations offices will help assure that we are planning in a cost-effective manner.

The Master Safeguards and Security Agreements (MSSA's) are among the most important initiatives in our planning approach. They document a binding agreement regarding the acceptable levels of protection for critical facilities and strike a balance between inherent risk and incremental costs associated with additional protection measures for the Department's major facilities. They are "living documents" that support a graded approach to safeguards and security planning and programming throughout the Department.

In addition to the Five-Year Plan and MSSA's, a comprehensive review is being undertaken to ascertain which levels of standardization may be possible for safeguards and security equipment and the best methods to implement the procurement of standardized equipment having specifications based upon performance requirements. The results of these studies may serve to reduce or better manage inventory levels, simplify training of security inspectors, enhance safety, and reduce equipment costs through a common procurement procedure. This initiative is another critical component in our "proactive approach" towards planning and establishing the Department's safeguards and security crosscut estimates.

It is believed that these initiatives are representative of a corporate planning approach designed at assuring that our resources are applied based on the consequences of loss and associated risks to the public health and safety and national security. In addition, the planning approach will help assure appropriate Departmental coordination, consistency, and the development of forward-looking plans in the area of safeguards and security.

Central Training Academy

As discussed before this Committee last year, the Department has continued to focus direct management support on top quality training for its contractor protective force personnel at the Central Training Academy (CTA) in Albuquerque, NM. During the past year, the CTA has taught courses in hostage negotiations, supervisory qualification, firearms safety, tactical response, arrest authority, and use of force. In addition, the CTA's expertise is being applied to other safeguards and security areas of concern. For example, the CTA has examined standardization and safety aspects of firearms throughout DOE facilities. In addition, another assessment is underway at the CTA to evaluate and recommend options for DOE's procurement and use of hardened vehicles. Responding to a specific need to answer the elusive question, "How much is enough?," the CTA has been providing tactical vulnerability analysis training programs designed to enhance onsite protection planning for safeguards and security improvements. The CTA has proven to be an extremely valuable asset to the Department in its short period of existence. Because of the top notch quality of its faculty, CTA advice and methods are much sought after by other Federal agencies as well as state and local law enforcement organizations.

Guidelines for "Hot Pursuit"

Section 161.k. of the Atomic Energy Act (42 USC § 2201(k)) was recently amended (Defense Authorization Act of 1987 - PL99-661) at the Department's urging to ensure our contractor protective force personnel had sufficient legal authority to pursue "fleeing felons" beyond the boundaries of sensitive DOE facilities. Draft procedural guidelines have been developed, and are currently under review, which would ensure that all sites implement their "fresh pursuit" instructions in a consistent manner. These guidelines are expected to be finalized within the next few months.

Physical Fitness for Security Inspectors

I am pleased to report that the Department's continuing physical fitness program for our protective force personnel remains a successful one. These locally developed and administered training programs better ensure that our protective force personnel have the ability to successfully sustain the physical stress of responding to potential emergency conditions. The relatively new program requirement (as promulgated by 10 CFR Part 1046) is now in its fourth year of implementation.

Nuclear Material Control and Accountability

The Department's initiatives and programs over the past several months have included revisions to the graded safeguards approach to improve efficiency. These revisions have been included in the DOE orders and guides are under development for implementation. Aided by improvements in measurement technology and data analysis techniques, nuclear material control and accounting practices are now being increasingly emphasized at key DOE sites to identify improvements that will help address concerns such as special nuclear material diversion that might be masked by measurement uncertainties or falsification of data. Nuclear materials measurements and related control programs are vital to effective safeguards in meeting the needs of detection and confirmation that no diversion has occurred. The Office of Safeguards and Security is sponsoring efforts at DOE national laboratories and the DOE New Brunswick Laboratory to assure that all potential avenues of material flow across material balance areas within the DOE complex are controlled and accountability maintained.

Visits and Assignments Initiative

We are participating in an effort to improve security for the Department's unclassified visits and assignments program. Each year our laboratories host many visitors and assignees from foreign countries under agreements for cooperation or on a scientist to scientist basis. While these interactions are an integral part of the scientific process, they could result in the inadvertent disclosure of classified or sensitive information if not conducted properly. Because of such concerns, we are developing a revised security policy to improve physical and technology security and security awareness for the visits and assignments program.

Technical Surveillance Countermeasures Program

DOE's technical surveillance countermeasures (TSCM) program is intended to ensure that no opportunity exists for audio or optical data to be surreptitiously extracted from its facilities. During the past year, DOE began revising the TSCM element of the technical security program. Included in this effort has been an extensive rewrite of the procedural documentation used to operate the TSCM program at DOE and DOE contractor sites. The implementation of these documents, along with the issuance of a new TSCM policy order, will result in better management of program resources and make services more efficient and cost effective. This new policy will effectively implement a program of using TSCM resources for preconstruction advice and assistance during construction planning stages to prevent later security modifications and corrections in building construction. This program will eliminate most unnecessary expenditures and manhours used in facility reconfiguration.

In addition to these management and operations enhancements, training for DOE contractors performing TSCM services was identified as an important initiative. A DOE Technical Security Resource Center (TSRC) has been established and will undertake the task of providing up-to-date TSCM training for all contractor technicians and management personnel. Planning is also underway to provide DOE contractors performing TSCM services specialized training at national training centers.

These efforts toward improving policy, procedures, and services are initiatives directed by the Department's management in recognition of national level concerns for the proliferation of technical collection systems directed against sensitive facilities. The programmatic changes will make significant improvements in the overall technical security posture at the Department's facilities.

Classified Document Control Initiative

As a result of a special initiative during 1987 which indicated that classified document control throughout DOE needs improvement, planning and scoping work has been initiated within the Department to improve security policies, practices, and procedures. Requirements for control of Restricted Data are contained in the Atomic Energy Act of 1954, as amended, and Executive Order 12356 contains requirements for control of National Security Information. Implementing procedures are set forth in DOE orders. To this end, a major initiative has been the review and revision of Departmental orders regarding the handling and protection afforded DOE classified information.

Even with the revised policy and procedures, many other areas and concepts need to be further explored and evaluated. Such administrative areas as improved reproduction restrictions and controls and mandatory document destruction (inventory reduction) will be reviewed and policies developed to ensure the propagation and retention of documents is kept to an absolute minimum.

Perhaps the most aggressive and visible area of improvement will be concentrated on the education and training aspects of document control. Several standardized courses of instruction have been proposed and outlined which, when approved, are intended to impact consistent and standardized classified information control concepts throughout the DOE complex.

In addition, our responsibilities for protection of Restricted Data and Formerly Restricted Data exchanged with our allies in the NATO community have become increasingly important. As mandated by the Atomic Energy Act of 1954, as amended, and Executive Order 10841, DOE, together with the Department of Defense, will continue to emphasize protection applied by reviews of the NATO community.

Classified Computer Security Program

Our classified computer security program is directed toward assuring the necessary level of computer and information security while maintaining maximum productive output. In part, this is a greater definition of management responsibilities.

Management involvement is being accomplished by the establishment of a formal planning process for the classified computer security program. This provides a means for identifying resource requirements such as personnel and dollars and for the orderly implementation of new technologies. It also provides for coordinating computer security with other security activities in DOE.

The classified computer security program has defined and adopted a method to assist in the determination of the level of protection necessary for classified computer systems operating in a variety of environments. This method encourages the use of the latest advances in computer technology to provide the necessary levels of protection. A major initiative is the application of this method to all classified computer systems.

A significant activity of the classified computer security program in the DOE has been, and continues to be, the Center of Excellence for Computer Security located in the Los Alamos National Laboratory. The Center provides support for the education and training of managers, computer security personnel, and information users. It also provides field support and conducts research and development in a variety of elements related to computer security.

The classified computer security program has also been closely involved with the DOE weapons design, manufacturing, and testing program in the development, testing, and implementation of a large network to support the Nuclear Weapons Complex.

The rapid growth of computer networks has become a significant challenge to the available technology in computer security. The classified computer security program in the Department of Energy will continue to investigate new and innovative techniques to assure that adequate protection is provided to the vast amounts of information that can be stored and exchanged by these networks of computers.

Personnel Security Program

In 1986 we began a major initiative within the DOE to reduce the numbers and levels of clearances. This effort was continued through 1987 and will continue throughout 1988. Major reductions of the number of active clearances have taken place at some DOE offices; for example, DOE Headquarters reduced the number of clearances by one-third to a current level of about 13,000, and the Oak Ridge Operations Office reduced the number of active clearances by over 11,000 during 1987. We believe that continued emphasis on this initiative will serve to save resources and dollars dedicated to the Department's clearance activities. In 1987 we reviewed and revised the major personnel security program policy and procedural document, which should be issued for implementation in February or March 1988. The program policy is also undergoing further internal review by a special task force created by the Under Secretary as well as the Office of Security Evaluations which reports directly to the Assistant Secretary for Defense Programs. We look forward to the results of these reviews as they may provide recommendations that will assist in enhancing the program objective while reducing the amount of effort dedicated to the processing of clearance requests.

In 1987, all DOE offices submitted plans for approval to the Assistant Secretary for Defense Programs that reflected the manner in which each office would fully implement the requirements for conducting reinvestigations of all cleared persons. Based on these plans, we hope to have completed reinvestigations on all cleared persons by the end of FY 1992. Of course, successful completion of this effort relies on obtaining adequate staffing and program funding for this activity. The effort was initiated after the GAO reviewed the DOE personnel security program and recommended to the Secretary of Energy that such plans be generated and approved for implementation.

Human Reliability Program

The Department has an ongoing effort to design a Human Reliability Program (HRP) that would assure that employees in certain identified positions continue to display sound judgment. This program addresses and reduces the potential insider threat through periodic monitoring of both DOE and contractor employee reliability, and referral of potential problems to the occupational medicine and, through it, the employee assistance programs for possible rehabilitation. An HRP Task Force was created to address and develop agency regulations, directives, and implementation guidelines which were staffed with Headquarters, field office, laboratory, and operating contractor personnel with expertise in a broad variety of human quality assurance disciplines. A Center for Human Reliability Studies (CHRS) was established to assist in providing specialized expertise in various fields related to the HRP development and implementation.

Classification Management Initiatives

In support of the goal to maintain credible, up-to-date, and operationally practical classification policies and guidance, the Office of Classification's FY 1987 support activities focused on continuing active support for technical studies and analyses in such areas as inertial confinement fusion, computer codes, nuclear weapons testing, uranium enrichment, and safeguards and security. In addition, major program efforts continued for the review of sensitive nonnuclear technologies, including Strategic Defense Initiatives (SDI). Substantial progress was made in the development of classification education materials, appraisal training, and quality assurance procedures. A major new program effort was initiated to develop policy and guidance for the identification and protection of Unclassified Controlled Nuclear Information (UCNI) and other categories of unclassified controlled information. Substantial progress was made in international classification coordination efforts with the final development and implementation of the NATO ATOMAL Guide and Classification Management program.

THE BUDGET

The Nuclear Safeguards and Security Headquarters oversight program's budget request for FY 1989 is $80.2 million. Operating expenses require $75.4 million, and capital equipment $4.8 million.

The safeguards and security Headquarters program strategy directly supports oversight and technology development activities in support of domestic and international safeguards and security responsibilities. Oversight activities include: technical assistance to address vulnerabilities identified by onsite evaluations, protective force training, and nuclear materials control and accounting. Also the Office of Safeguards and Security oversees the Federal New Brunswick Laboratory. Technology development activities include a unique, nationally available technology base for physical protection, materials control, and nuclear materials accounting systems. This safeguards and security technology base is centered at the national laboratories for application by the Department's field operations and is shared with other Federal agencies and other countries who are partners in the promotion and application of improved safeguards and security strategies.

This safeguards and security request does not fund the construction, capital equipment, and operating expenses of safeguards and security systems at DOE field facilities. These costs are budgeted for and expended by the Department's outlay programs, which include the nuclear weapons, nuclear materials production, and the civilian nuclear energy and energy research programs.

Mr. Chairman, the FY 1989 request of $80.2 million consists of the following five basic elements which I will address. These include: safeguards and security operations, technology development, international safeguards, classification, and program direction.

SAFEGUARDS AND SECURITY OPERATIONS

This category supports the Headquarters oversight mission of protecting Departmental resources, which range from completed nuclear weapons to classified documents. At the heart of the oversight program is a uniform systematic approach to safeguards and security programs which can assure that proposed solutions are both effective and efficient.

Elements in this category involve three major functions: guidance and assistance to DOE field operations for safeguards and security system improvements; oversight of the Nuclear Materials Management and Safeguards System, which provides timely data on nuclear materials production, utilization, transfer, tracking, and storage; and the operation of the New Brunswick Laboratory, the safeguards analytical standards and field assessment operations laboratory at Argonne, Illinois.

Over the past few years, at no small expense, we have corrected deficiencies at DOE facilities. Field managers have applied state-of-the-art, large-scale hardening features and surveillance equipment; and have dramatically improved guard force response capabilities. I believe the Department has made DOE sites unattractive targets to any adversarial force.

We are now seeking to balance the protection systems in place against terrorist threat with an effective program against the full spectrum of threat, including protection against potential perpetrators who may actually have access to DOE facilities. Potential perpetrators include disgruntled employees, visitors, and assignees, and we must have programs to deal with them. We are pursuing several major management initiatives that comprise an integrated protection program against insiders. Key elements include: personnel clearance, human reliability, physical protection, information and document control, operations security, security education and awareness, intelligence community liaison, foreign travel/alien visits and assignments, and nuclear material control.

I have already touched upon initiatives in personnel clearance, human reliability, elements of physical protection, and document control. In recognition of the hostile intelligence threat to classified or sensitive unclassified DOE technologies or facilities, we will continue to maintain a strong operations security, or OPSEC, program. OPSEC is a key ingredient in our overall security protection program and is fully integrated both at Headquarters and all field elements. The Office of Safeguards and Security (OSS) has provided sufficient training for field personnel to conduct their own OPSEC vulnerability assessments and this process is well underway. Identified vulnerabilities are analyzed, countermeasures are developed, and their implementation is prioritized all at the local level. The OSS ensures the effectiveness of this program through an oversight management process.

We will also continue to operate our Security Education and Awareness program. This program was substantially improved in FY 1987 through revised policy establishing new requirements to strengthen the DOE program and implement new national policy. FY 1988-89 activities will include analyses in such areas as the human reliability program, foreign travel and visits and assignments activities, and insider and outsider threats, to determine appropriate changes which may be required in Security Education. We will continue conducting workshops and seminars, and providing educational materials throughout the DOE.

The Department has implemented NACSI 5004 in the TEMPEST program and will continue to control compromising electromagnetic emanations through a variety of countermeasures, including the use of zone tests. We will also continue the development of advanced technical surveillance countermeasures and suppression technology in support of the Intelligence Community technical security operations.

Central Training Academy

Advanced special weapons and tactics training, with a particular focus on realistic tactical situations, continues to be a critical ingredient in improving the capabilities of our protective forces. We are using our Central Training Academy (CTA) to provide uniform training standards and to improve supervisory effectiveness throughout DOE. The CTA instills a uniform and professional approach to protective force training in the tactical, operational, and technical aspects of physical security. The curriculum at the CTA will be expanded in depth and scope to certify instructors and training officers, to train tactical vulnerability assessment officers, and a variety of other safeguards and security discipline subjects and functions not being taught outside the Department of Defense. In 1987 the CTA provided training for 2,400 students onsite and offsite and offered 17 courses. In FY 1988, the CTA will provide training for 3,900 students and offer 31 courses. In FY 1989, it is projected that 5,400 students will be trained and approximately 37 courses will be offered.

Nuclear Material Management and Safeguards System

We will continue to operate the Nuclear Materials Management and Safeguards System (NMMSS), the nation's single nuclear material data base, in cooperation with the Nuclear Regulatory Commission (NRC). The tracking of nuclear material shipments involving DOE contractors, NRC licensees, and foreign trading partners is of paramount importance to DOE and an integral part of the Office of Safeguards and Security mission. NMMSS is charged with the responsibility of maintaining necessary information needed by facilities in order to verify the shipment and receipt of nuclear materials while reconciling nuclear material inventories held at DOE contractors. Each year, approximately 78,000 nuclear material transactions (e.g., approximately $10 billion in nuclear shipments, receipts, and inventory changes) from 130 contractors and about 900 licensees are entered into this system and tracked.

The purpose of maintaining the nuclear material data base is to ensure the safeguarding of material movements within the United States and abroad and the U.S. compliance with international treaties and public law.

New Brunswick Laboratory

The New Brunswick Laboratory (NBL) is our Center of Excellence in nuclear measurement technology and serves as the technical extension of the Office of Safeguards and Security in the areas of measurement science and material accounting. The NBL serves as the U.S. Government standards laboratory for nuclear materials measurements. Its functions include: maintaining and improving an internationally compatible reference base for nuclear material measurements; assessing and evaluating measurement technology in support of the DOE nuclear fuel cycle and weapons production activities; developing, certifying, and distributing reference materials for calibration and standardization of nuclear material measurements; and assisting in technology exchange and training in safeguards measurement technology.

Master Safeguards and Security Agreements

As I discussed earlier in this testimony, Master Safeguards and Security Agreements (MSSA's) are one of our most important initiatives. Continued high-level emphasis was placed on our MSSA program during the last year, resulting in the development of a draft MSSA order and guide, several MSSA's were completed, and more than 25 are in the planning and development stages.

A draft safeguards and security planning order and guide has been developed which incorporates the MSSA's, Facility Operational Plan, and Resource Plan for each facility into a cohesive facility planning and documentation process, to be known as the Safeguards and Security Site Plan's (SSSP's). This planning approach incorporates the basic elements of strategic, operational, and resource planning, and will help ensure a "graded approach" with consistent interpretation of risk of the Department's safeguards and security interests. It will also provide the flexibility to accommodate widely varying operations office situations and conditions, and eliminate duplication in reporting requirements.

In support of the MSSA process, the standardization of vulnerability assessments within the Department has led to the development and use of sophisticated, user-oriented, computer models. These models are critical for assessing the effectiveness of our facility protection programs and completing facility MSSA's. Continued refinement and improvement in the models will be made throughout the next 5 years, to include the development of a single integrated vulnerability assessment code by the end of FY 1990.

TECHNOLOGY DEVELOPMENT

Technology development continues to be an integral part of our safeguards and security program since advanced technology is necessary for improving control and accountability of nuclear materials, physical security, classified information control, and protection of government property. Technology development activities conducted at the national laboratories provides DOE with a technological base for developing new systems or applying existing technology to safeguarding the Department's nuclear facilities and materials. Results of these efforts are also made available to the other Government agencies.

Where appropriate, joint research efforts of mutual benefit to each agency, are identified. We will continue to emphasize close interagency coordination to minimize cost. Even though our research and development activities are coordinated with other agencies, fiscal constraints will continue to encourage us to urge other Government agencies benefiting from the technology base to increase their share of funding.

An integral element of the technology development planning, programming, and budgeting process is assessment of near-term and future risks, with the aim of investing in a development strategy that keeps risks at an acceptably low level. Such an assessment must take into account the spectrum of threats (i.e., the full range of characteristics and resources as opposed to separate focus on the "outsider" and the "insider"), including the trends and directions of change in the threats. DOE has taken steps to improve the leverage of technology development for enhanced capability to mitigate the threat to DOE facilities. These steps encourage preplanned and affordable improvements. In addition to solving a problem and enhancing safeguards and security capabilities, evaluation criteria require a proposed technology development project to offer potential reductions in operational outlay ("crosscut") estimates for safeguards and security. This provides an incentive and leverage to improve both effectiveness and efficiency of the overall safeguards and security mission, and requires close coordination with outlay programs and designs to influence and provide timely cost effective performance criteria for new DOE facilities and processes.

As for the classified computer security program, it will continue to implement national policy in computer and information security and has initiated a management review process to provide oversight of the implementation of DOE policy. This program also supports the Center of Excellence for Computer Security located at the Los Alamos National Laboratory. The classified computer security program will continue to develop new and innovative techniques to assure that adequate protection is provided to the information stored or transferred by Department of Energy computers and computer networks.

INTERNATIONAL SAFEGUARDS

Our international safeguards program supports U.S. nonproliferation and national security objectives to minimize the proliferation of nuclear weapons. The activities of program staff and contractors are required by the Atomic

Energy Act of 1954, the Nuclear Non-Proliferation Act of 1978, the Omnibus Diplomatic Security and Anti-Terrorism Act of 1986 and implementing Executive Orders and Presidential directives. The primary objective is to strengthen international safeguards and physical protection through technical support to the International Atomic Energy Agency (IAEA) and cooperative efforts with other nations. Research and development will continue on new and improved technologies and systems for IAEA safeguards, including efforts on safeguards for reprocessing plants and for mixed-oxide (plutonium and uranium) fuel fabrication plants. These efforts reflect the increasing use of plutonium as fuel in civil nuclear fuel cycles. An important aspect of our research and development is increased bilateral cooperation, including technical exchanges with the Federal Republic of Germany, France, the United Kingdom, and Japan, as well as the inspectorate of the European community. These bilateral efforts optimize the research and development efforts of the U.S. and other nations through exchanges of information, staff, and equipment on international safeguards and physical protection of nuclear materials. Additionally, the application of the atomic vapor laser isotope uranium separation (AVLIS) process for enrichment will introduce a new requirement for development of international safeguards methods and equipment for use with AVLIS under the U.S./IAEA agreement for the application of international safeguards in the U.S.

Beginning in FY 1988, we will expand international safeguards cooperation with Japan. This increase in cooperation will also help the DOE develop the most advanced safeguards technology for a new plutonium fuel fabrication facility and other Japanese facilities to meet IAEA safeguards requirements. Development costs will be borne by Japan but the technology developed could have wide application where other countries are also expanding uranium/plutionium processing facilities such as the FRG, U.K. and France.

Compliance with international agreements and nonproliferation objectives requires that we monitor certain international shipments of U.S.-origin materials and tracking of foreign origin materials in the U.S. Other continuing activities include recording exports, imports, and transfers of materials of foreign origin in the U.S.; reporting to the IAEA under the U.S./IAEA Safeguards Agreement and other agreements; and determining inventories of nuclear materials for bilateral agreements for cooperation.

PROGRAM DIRECTION

Our program direction supports a total of 148 Headquarters full-time equivalent positions, which includes the staff for the classification program.

CLASSIFICATION

The FY 1989 request for the Classification program, which is incorporated in the Nuclear Safeguards and Security program budget, is $4.6 million. The FY 1989 Classification program will continue at the FY 1988 level of effort. The Office of Classification manages and implements the Department's program for the classification, declassification, and control of information in the interest of the national security.

The FY 1989 request will continue active support for the review of potentially sensitive DOE research and development activities, as directed by National Security Decision Directive-189 (NSDD-189) and for classification development and oversight activities in program areas involving sensitive technologies including Strategic Defense Initiatives, nuclear testing, and other nuclear weapons areas. In addition, international coordination efforts will continue with the implementation and monitoring of NATO ATOMAL classification management functions. Efforts will continue on the development of policy and guidance for the identification and protection of Unclassified Controlled Nuclear Information and other categories of unclassified controlled information, as well as concentrating efforts on development of guidance in such priority areas as computer codes, isotope separation, and safeguards and security. Support will be provided for enhancement of classification education and training efforts. Efforts will continue on improving the effectiveness and efficiency of the classification and control program through enhanced automation activities. Continuing support will be provided for the

Office of Classification's appraisal, quality assurance, and document review programs.

SECURITY INVESTIGATIONS

The FY 1989 request for personnel security investigations is $40.0 million. Background investigations are required by the Atomic Energy Act of 1954, as amended, and by Executive Orders 10450 and 10865. The Department is not permitted to conduct its own investigations; hence, we rely on and reimburse the Federal Bureau of Investigation (FBI) and the Office of Personnel Management (OPM) for conducting investigations of DOE employees, contractor employees, and consultants assigned to critical sensitive positions prior to their being granted access to classified information, classified materials, or special nuclear materials.

In order to have efficient program management and be consistent in meeting security requirements, we use this single program to meet the strict requirements of the Atomic Energy Act of 1954 to ensure that granting access to classified information, classified material, or special nuclear material (SNM) will not endanger the common defense and security. Most background investigations directly support Defense Programs since the Department believes any clearance or access determination is directly related to protecting the common defense and security. The DOE is continuing to review access authorization levels system-wide and lowering many Q-"Sensitive" access authorizations requiring an FBI reinvestigation to Q-"Nonsensitive," requiring an OPM reinvestigation, or even lower levels. Individuals with clearances whose duties do not require them to have access to classified data or SNM are having their clearances terminated.

During the last year, the OPM has not made significant progress in reducing the time required to conduct a background investigation. However, OPM has recently obtained approval from the OMB to hire an additional 180 investigators. With the additional investigators and the close out of their private sector contractor investigator effort, OPM hopes to reduce the investigative times during FY 1988. Unfortunately, OPM has experienced difficulty hiring investigators, so we have not yet realized reduction in investigation time we hope for.

Our FY 1988 budget provides for approximately 29,000 initial full-field investigations and all National Agency Checks with Credit and 22,000 reinvestigations. This reinvestigation total includes almost 11,000 reinvestigations using prior year funds. In FY 1989, the full-field investigations and National Agency Checks will increase to approximately 31,000, and total reinvestigations will be approximately 20,000.

SAFEGUARDS AND SECURITY CROSSCUT

As I mentioned earlier, the DOE outlay programs fund safeguards and security activities at the Department's field facilities. Total safeguards and security funding is approximated in the Department's crosscut estimate, which is a rough summation of all safeguards and security items in the Department's program requests, including the budget for the Office of Safeguards and Security. The crosscut estimate for FY 1989 totals $868 million, with $735 million as the defense activities portion.

As the Departmental coordinator for all DOE safeguards and security activities, Security Affairs has a range of responsibilities for safeguards and security crosscutting activities which include ensuring that program budget submissions properly reflect judgments that have been made with respect to security considerations. For example, the major construction upgrades at critical nuclear weapon facilities, such as Savannah River, Pantex, and Oak Ridge, which provide enhanced integrated protection programs against the Department's defined threats, were fully coordinated with and supported by Security Affairs. We validate the need for safeguards and security improvements, evaluate proposed upgrade designs for adequacy, and verify the performance of the upgrades once they are in place. This process is critical if we are to assure continued protection system progress in upgrading our critical facilities, and effective safeguards and security integration. Significant progress has and continues to be made towards increasing the level of protection of our facilities and the protection of DOE assets. A good portion of this has been accomplished through guard-intensive, quick-fix measures. The validation of major construction projects designed to provide long-term permanent corrective action to vulnerabilities is critical to assuring effective safeguards and security integration and the replacement of existing systems with more state-of-the-art hardware and software protective measures. When this is accomplished, our safeguards and security program will be well along towards achieving our objectives.

I would now like to discuss the FY 1989 budget request for Verification and Control Technology.

VERIFICATION AND CONTROL TECHNOLOGY

In the following sections, I will describe the program elements within the V&CT program and give you a view as to how these elements fit into the overall program.

The overall goal of the V&CT program is to support the development and execution of U.S. national security and foreign policies in the areas of treaty verification, intelligence, arms control, and control of sensitive technologies as they pertain to the Department of Energy's (DOE) responsibilities. Specifically, the program:

o Conducts advanced research, development, and fabrication of detection, identification, and characterization systems to support nuclear related treaty verification requirements;

o provides technical and analytical support for DOE's role in nuclear arms control negotiations and related interagency deliberations;

o reviews the export of technology, materials, and equipment related to DOE areas of responsibility;

o provides for foreign intelligence support to the Department on the entire range of its responsibilities; and

- manages and facilitates the transfer of defense-related technology developed by DOE and its contractors to the U.S. private sector, ensuring consistency with U.S. national security and non-proliferation policies and objectives.

The V&CT activities are managed under the Deputy Assistant Secretary for Security Affairs and the Deputy Assistant Secretary for Intelligence (DASI), and are carried out by DOE Headquarters staff, the national laboratories, and DOE contractors. The program efforts are carefully coordinated in the interagency arena with the Departments of Defense (DOD), State (DOS), and Commerce (DOC), the Arms Control and Disarmament Agency, Defense Advanced Research Projects Agency, the Intelligence Community, and the Nuclear Regulatory Commission (NRC).

V&CT activities can be divided into three broad categories: (1) detection/verification technology research and development; (2) analytical support; and (3) threat assessment.

The detection technology programmatic objective encompasses the research and development (R&D) of technologies, the required production or fabrication of systems for verification of current and potential arms control treaties, and for monitoring associated foreign treaty related activities. Detection technology final products contribute substantially to the development of the national technical means for the monitoring and verification of nuclear and advanced concept weapon treaties, both current and potential. Long-term efforts are focused on assuring that technological capabilities for verification meet national needs, maintaining a robust and survivable satellite sensor program, enhancing regional seismic verification capabilities, accelerating directed energy monitoring, pursuing an evolving group of non-seismic verification projects, and maintaining a broad technology base.

Analytical support activities are conducted within the V&CT program.

Arms control analytical support activities are directed toward the development, establishment, and implementation of Administration policies toward treaty negotiations and verification. Studies on arms control approaches and their likely impact on overall arms control goals, together with technical support, are provided at interagency and international arms control policy and treaty verification/compliance deliberations. These constitute a significant portion of the DOE presence in arms control actions.

Within the V&CT, detection technology analytical support activities are closely coordinated to ensure that the policy guidance developed in the interagency arena is used to direct the development of treaty verification technologies. Conversely, the results of verification technology development are used to ensure that treaty negotiations are constrained within technically verifiable limits. This approach allows for effective, efficient, and concurrent treaty policy and technology development.

The programmatic objectives of additional analytical support activities are directed at controlling sensitive technology through the export control review process and implementation of technology transfer/ nonproliferation policies. A number of these responsibilities are fixed by statute (e.g., the Atomic Energy Act and the Nuclear Nonproliferation Act of 1978) and Executive Order 12333. Others are policy responsibilities resting in DOE. Export control and technology transfer concerns derive from national security and nonproliferation-related policy and lead to positions on the export, distribution, and transfer of strategically significant technologies as well as sensitive nuclear technology, nuclear materials and equipment. In addition, DOE develops views on the export of other significant items or substances for nuclear explosive purposes and participates, as appropriate, in related interagency activities in the Executive Branch.

The DOE is tasked by Executive Order 12333 to: provide expert technical, analytical, and research capability to the Intelligence Community; formulate intelligence collection and analysis requirements where the expert capability of DOE can contribute; produce and disseminate foreign intelligence necessary for the Secretary of Energy's responsibilities; and participate with the DOS in overtly collecting information with respect to foreign energy matters. The nature and scope of these intelligence activities will continue to be influenced by a variety of international events and trends, particularly in the areas of nuclear and non-nuclear energy policy and technology, strategic petroleum issues, defense and national security policy, and weapons technology development.

The other primary V&CT program area is in the arena of domestic threat assessment. The Office of Threat Assessment (OTA), under the DASI, consolidates the DOE threat analysis activities within a single office to provide timely assessment of actual or potential threats to Department facilities and activities. These assessments are provided to the Secretary, appropriate Assistant Secretaries, DOE Headquarters program offices, and field elements. This program is responsible for: coordination of information requirements with appropriate federal, state, and local government agencies and organizations; in cooperation with the Office of the General Counsel, development and implementation of pertinent DOE directives, regulations, and procedures governing information collection, storage, and dissemination; development and maintenance of data bases in support of threat assessment activities; and preparation and dissemination of finished analyses.

Detection Technology

This V&CT program element performs basic research, develops technologies and analytical tools, and fabricates and supports systems for nuclear-related treaty verification and for Intelligence Community technical intelligence collection support. The resources of the DOE national laboratories are strong participants in these programs, in most circumstances at the forefront of the scientific and technical state-of-the-art. Detection technology projects range from seismic to satellite instrumentation, from Deleted Deleted gamma radiation frequencies, sensors at ranges of centimeters to millions of miles, and immediate read-out to the longer term sophistication of Cray computer processing time.

Programmatically, detection technology projects are structured to support the Limited Test Ban Treaty (LTBT), the Threshold Test Ban Treaty (TTBT), the Peaceful Nuclear Explosives Treaty (PNET), the Intermediate Nuclear Forces Treaty, and other potential treaties such as Strategic Arms Reduction Talks (START).

Verification of the LTBT is accomplished through the development of satellite instrumentation for the detection, identification, location, and characterization of nuclear detonations, in the atmosphere, or in space.

Under this program, we fabricate satellite sensor payloads, satellite-borne sensors which provide monitoring of compliance with the LTBT and also support data collection on potential proliferating nations and on nuclear weapon states that are not LTBT signatories.

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Most of the DOE sensor systems are a part of the Integrated Operational Nuclear Detonation Detection System (IONDS), carried by the satellites of the Global Positioning System and the Defense Support Program (DSP). These DOE-produced sensors provide worldwide surveillance and FY 1989 satellite instrumentation development and fabrication efforts are impacted by the need for the DOE to fulfill its responsibilities

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DOE sensor systems are also carried as piggyback or secondary mission payloads on classified satellites developed and procured by the Air Force Space Division and operated by the Air Force Space Command.

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The on-site monitoring activity develops the capability to monitor compliance with the yield constraints of the TTBT and PNET . The discussions underway with the Soviets concerning improved verification of the TTBT are based on the DOE developed on-site monitoring technology. The V&CT program is charged with providing modern equipment, manpower, expertise, and a full range of capabilities to permit the United States to fulfill its PNET and TTBT verification responsibilities. DOE has developed and evaluated hydrodynamic yield measurement (Continuous Reflectrometry for Radius versus Time Experiment, (CORRTEX)) as a monitoring technique. CORRTEX can be combined with complementary teleseismic system

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In addition to teleseismic measurements, the DOE is working on in-country seismic capability for using seismic verification at regional (short-range) distances. This emphasis is to ensure that DOE can fulfill any national decision to provide equipment and systems to support U.S. verification of any future treaties related to further constraints on underground nuclear tests. An example of technology developed under our program is the regional seismic array approach that is embodied in the Norwegian Regional Seismic Array. The objective is to reduce the error range of yield estimates of nuclear tests Deleted Deleted by using additional regional arrays. The first five units of the Deployable Seismic Verification System (DSVS) are under construction. Any future treaties that further constrain nuclear testing will depend on such a capability to enhance confidence in Soviet compliance with treaty obligations. These systems may be used in a regional monitoring role for improved yield estimation at lower levels, or for general in-country monitoring. The latter case would require a significantly larger number of units than are now planned.

In addition to its verification efforts for treaties constraining nuclear explosions, the detection technology program develops gaseous and particulate radioactivity monitoring systems for sample/debris detection and analysis. Collection and analysis of fresh radioactive debris provides the only unambiguous evidence of clandestine nuclear activities, an area of increasing concern in the current environment where third-world countries are developing their nuclear capabilities. The result of this effort will be monitoring facilities with high sensitivity, on-site analysis capabilities, and telemetry of real-time data to a central monitoring facility.

Other monitoring activities include R&D of means, other than optical and seismic, for detection of nuclear detonations. Seismic nuclear explosion verification activities are long-standing and appear to be approaching maximum levels of capability for any particular seismic distance. Nonseismic means of detecting nuclear explosions - especially for a possible lower yield threshold - are essentially nonexistent. Because of the vast area of the Soviet Union that is seismically active and the potential for treaty evasion that such seismic activity offers, other technical means of monitoring nuclear explosions require investigation. These means would complement existing or developmental seismic verification capabilities.

Directed Energy Weapons (DEW), both ground-based and in space, are of increasing interest.

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Therefore, research must be conducted on techniques for monitoring these activities.

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Our program supports documented requirements for characterization of all DEW systems. As a natural outgrowth of these characterizations and our laboratories expertise in these disciplines, we are developing sensors, systems, data handling, processing, and analysis capabilities. Ongoing work also concerns a viable satellite attack warning system to enhance the survivability of U.S. satellites to foreign attack.

As the last major element in detection technology, we are managing the basic research and technology development of advanced concepts. In these projects we are exploring concepts and basic technologies which can provide sensors or analytical tools in support of multiple projects within the program. Although prototype systems are also developed, our primary interests here is assuring that technology is available for incorporation into these systems. We have adopted a policy which is still relatively new within the technical intelligence collection R&D community; i.e., the concurrent development of the analytical tools necessary when any collection system is prototyped. This approach allows us to provide "turn-key" systems to the Intelligence Community from the expertise of the DOE national laboratories, thereby avoiding the customary delay when data is collected, but the analytical tools have not been developed.

Analytical Support

The objectives of the arms control program of applied research and policy support are: to continue to support interagency and international policy deliberations and negotiations, to provide programmatic support for improvement of arms control techniques and approaches, and to maintain the capability to supply technical support in the arms control arena. To meet these objectives, our work program is divided into three categories: (1) studies and analyses of current active issues, (2) studies directed toward future issues, and (3) quick-reaction response to current events. The in-house staff and selected expertise from the national laboratories and contractor support allow us to bring to bear the best expertise in the nation on problems associated with these issues.

Among the most important policy activities is the implementation of the Administration's arms control policies, as communicated in the President's National Security Decision Directives and other sources. Other sources include arms control policy deliberations and U.S./Soviet arms control negotiations and technical discussions.

The DOE's responsibilities in export control and technology transfer follow from statutory requirements and Executive Orders. The DOE is one of a number of agencies involved in the regulation and control of technologies, material facilities, and component exports that relate to the U.S. national material security and nonproliferation interests. In addition to providing operational support to other agencies in the export licensing process, DOE recommendation is required for selected transfers and licensed exports by the NRC, DOC, and Office of Munitions Control. In this connection, DOE must maintain the capability to review and process in a timely fashion more than 10,000 export license applications annually in support of the DOC.

In the area of transfer of sensitive nuclear technology, DOE has developed and implemented revised procedures and orders for processing foreign national visits and assignments, continues to consider new policies and procedures, and will review these requests as well as foreign travel of DOE and DOE contractor personnel to sensitive areas. DOE will also continue to support revision of the Militarily Critical Technologies List, with special emphasis on SDI-related technologies. We will also continue to participate, as required, in the interagency working groups, committees, and panels that address the technical and policy issues associated with technology transfer.

Deleted

A major initiative begun during FY 1986 was the OTA, organizationally located under the DASI. OTA consolidates the DOE threat analysis activities within a single office. This program supports the Department by providing timely assessments of actual or potential threats to the Department's facilities and activities (programmatic threat assessment), as well as supporting the total U.S. Government by providing expert technical capability to evaluate threats involving nuclear material and/or facilities (communicated threat credibility assessment). OTA tasks include: coordination of information requirements with appropriate federal, state, and local government agencies and organizations; development and maintenance of data bases in support of threat assessment activities; and preparation and dissemination of finished analyses.

INITIATIVES

The budget request for FY 1989 ($140M) is larger than the FY 1988 V&CT budget ($121M), primarily due to the requirements to support national arms control activities which have recently intensified.

The first definitive activities in Joint Verification Experiments (JVE) will occur in the spring of 1988. DOE must be prepared to conduct a JVE in the U.S.S.R. then, as well as during FY 1989. This requires equipment, procedures, manpower, and substantial training. Administrative policy is already in place for this important undertaking and DOE has the responsibility to supply the technology and the capability to implement this policy.

Improved verification of the TTBT will come about through the use of the hydrodynamic yield measuring system developed by DOE, CORRTEX. This is the linchpin to the technology advanced by the administration for improved TTBT verification. However, there still remain elements of this technology to be more fully examined. For example, experiments are being planned to address reducing further the measurement uncertainty. Procedures are being evolved to guarantee the integrity of the data required.

Acquisition of equipment to support a future fielding of the DSVS will be continued in FY 1989. Additionally, seismic verification efforts will be expanded to improve automated signal processing and development of discrimination capabilities.

The V&CT program continues to make investments in research in order to increase future capabilities in verification technology. In FY 1989, a major initiative will be expanded to provide the United States with systems to improve our capability to verify the provisions of a START treaty. Significant support will be required to determine the feasibility of new concepts for longer range detection of treaty prohibited nuclear weapons. In FY 1989, research efforts will be structured to look toward future technological issues of detection, identification, and measurement of directed energy. In the future, there almost certainly will be a need to understand these problems and their resolution as DEW technology evolves and matures.

The BSTS is the early warning satellite system the nation will deploy to replace the present DSP system. In order to maintain the competence of the Atomic Energy Detection System, DOE will outfit each of the BSTS satellites with nuclear explosion detection instrumentation similar to that used on the DSP satellites. This program began in FY 1988 and will expand significantly in FY 1989 to meet the required launch schedule for the first prototype system.

SUBCOMMITTEE RECESS

Senator McClure. The subcommittee stands in recess.

[Whereupon, at 11:52 a.m. Friday, March 25, the subcommittee was recessed to reconvene at 10 a.m. Monday, March 28.]

ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1989

MONDAY, MARCH 28, 1988

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 10:04 a.m. in room SD–192, Dirksen Senate Office Building, Hon. Mark O. Hatfield presiding.

Present: Senator Hatfield.

DEPARTMENT OF ENERGY

POWER MARKETING ADMINISTRATIONS

BONNEVILLE POWER ADMINISTRATION

STATEMENT OF JAMES J. JURA, ADMINISTRATOR,

ACCOMPANIED BY:
- **STEVE AILSHIE, FINANCIAL MANAGER**
- **ROGER SEIFERT, WASHINGTON, DC, DEPUTY**
- **JACK ROBERTSON, DEPUTY ADMINISTRATOR**
- **LEE JOHNSON, WASHINGTON, DC, ASSISTANT ADMINISTRATOR**

OPENING REMARKS

Senator HATFIELD. The hearing will come to order.

We are very happy to welcome Mr. Jura to the subcommittee. He is the Administrator of the Bonneville Power Administration.

On behalf of the committee, Mr. Jura, we are not only pleased to have you here, but your associates as well.

Mr. Jura, I note from your written statement that BPA's request is just 2.9 percent over last year's budget and that you have been making very regular payments to the U.S. Treasury, and that you even assume a net payment of nearly $1 billion during the next 2 years.

My reason for requesting this hearing this morning is to discuss the ongoing drought in the West and to determine what impact, if any, it might have on your operations, including your Treasury payments for the coming year. As well, I am disturbed, not so much by the numbers in your budget, but by the review process your budget has undergone within OMB, so I will have some questions on this and other matters later on.

I would like to note that while Mr. Jura is our only witness this morning, the other Power Marketing Administrations will be allowed, at their discretion, to submit written testimony covering their 1989 budgets. All of those statements will be made part of the record at this point.

And Mr. Jura, your entire statement will be incorporated in the record, and you may proceed to highlight it or read it, as you wish.

[The statements follow:]

PREPARED STATEMENT OF DONNA R. FITZPATRICK, ASSISTANT SECRETARY FOR CONSERVATION AND RENEWABLE ENERGY

Mr. Chairman and members of the subcommittee, I am pleased to be here with the five Power Marketing Administrators to present their budget requests for fiscal year 1989.

First, let me introduce my colleagues: Robert J. Cross, Administrator of the Alaska Power Administration; James Jura, Administrator of the Bonneville Power Administration; Harry Geisinger, Administrator of the Southeastern Power Administration; Ronald H. Wilkerson, Administrator of the Southwestern Power Administration; and William H. Clagett, Administrator of the Western Area Power Administration. Each of the Administrators will speak to the budget needs of his own agency.

In fiscal year 1989, the Department will continue its efforts to sell the Alaska Power Administration. The Administration's activities will be coordinated with Congress and with existing power customers and legislative authorizations will be sought prior to implementation. Also, we will seek enactment of legislation authorizing a study of the divestiture of the Southeastern Power Administration. The administration believes that divestiture can lead to creation of new enterprises that are more responsive to regional and customer needs, without significant increases in power rates.

Mr. Chairman, that completes my testimony. The Power Marketing Administrators have statements on their budget requests and we will be glad to answer any questions you may have.

BIOGRAPHICAL SKETCH OF DONNA R. FITZPATRICK

Donna R. Fitzpatrick was sworn in as Assistant Secretary for Conservation and Renewable Energy, U.S. Department of Energy, in December 1985. She had served as Acting Assistant Secretary since March 1985, and as the Principal Deputy Assistant Secretary since January 1984.

In this position her responsibilities include management of research and development programs in energy efficiency and alternative fuels for industry, buildings, and vehicles. The programs in renewable energy resources involve research in active and passive solar, photovoltaic, wind, ocean thermal, geothermal, and biomass technologies. In addition, she administers federal grant programs for low-income home weatherization and energy efficiency improvements in schools and hospitals, and coordinates management of three of the five federal Power Marketing Administrations.

In 1983, Miss Fitzpatrick served on a consultant team for the Secretary of Energy to conduct a general review of the Department's conservation and renewable energy programs, focusing on policy, program goals and priorities, budget levels, and new initiatives. In 1980, she served the Office of the President-elect as a member of the transition team for the National Science Foundation, reviewing national policy in basic science research, project efficiency, funding, and proposed legislation.

In her law practice, first with the Washington, DC, firm of O'Connor & Hannan and then as a sole practitioner, Miss Fitzpatrick worked extensively on real estate development, property and tax law, business organization, and civil litigation, including administrative law and contracting issues.

Miss Fitzpatrick received a bachelor's degree in physics cum laude from the American University in 1972. After teaching high school chemistry and mathematics, she entered law school and graduated from the National Law Center of George Washington University in 1980.

PREPARED STATEMENT OF JAMES J. JURA, ADMINISTRATOR, BONNEVILLE POWER ADMINISTRATION

Mr. Chairman and Members of the Committee, it is a pleasure to come before you once again as Administrator to present the Bonneville Power Administration's [BPA] Fiscal Year [FY] 1989 Budget. First, I will briefly summarize the budget, then I want to take a few minutes to tell you about BPA's financial situation and the actions we are taking to assure that we will meet our commitments.

THE FY 1989 BUDGET IN BRIEF

BPA requires no annual appropriations. In keeping with our responsibilities as an electric utility, the Federal Columbia River Transmission System Act of 1974 provided BPA with permanent and indefinite authority to finance its programs on a business-like basis from power sales revenues and proceeds from bond sales to the Treasury.

I am pleased to report that FY 1987 marked the 4th consecutive year that we have made our planned Treasury payment in its entirety. Through FY 1987, BPA had returned over $5 billion to the U.S. Treasury for interest and amortization on the Federal investment in hydroelectric projects and transmission facilities in the Columbia River Power System. During FY 1988 and FY 1989 we plan to repay the Treasury $1.3 billion and borrow $301 million, resulting in net payments of over $1 billion into the Treasury.

The net payments represent reimbursement of Treasury costs of financing the Federal Columbia River Power System and reimbursement of Federal agency costs of operating the hydropower generation facilities. At the end of FY 1987, the amount of unpaid Federal investment in power and irrigation facilities assigned to BPA for future amortization was $9,070 million. This amount includes investments financed by annual appropriations as well as those financed by borrowing authority. The amount of unpaid investment increased by $391 million from the end of FY 1986 to the end of FY 1987. Under our proposed budget plan, the level of the unpaid investment is projected to be $9,135 million at the end of FY 1988 and $9,206 million at the end of FY 1989.

There are no major new initiatives in our FY 1989 budget. Our planned obligations for FY 1989 increased by just 2.9 percent ($70.5 million) over the FY 1988 levels. Total obligations of $2,845.3 million and capital transfers of $335.8 million will be financed through revenues from operations ($2,975.1 million), reimbursements ($110.4 million), and funds borrowed from the U.S. Treasury ($136 million).

OPERATING IN A COMPETITIVE ENVIRONMENT

Mr. Chairman, BPA operates in a very competitive environment with revenues that are subject to wide fluctuations, depending on the price of aluminum, the prices of oil and natural gas, and the weather. In fact, in our last rate case, we estimated our revenue risk during the rate period to be from $350 to $400 million a year. We must maintain the financial flexibility to respond quickly to both the risks and opportunities that we face. Although these revenue swings are largely outside our control, there are actions we can take to assure strong financial performance. We intend to maintain stable, low-cost rates over the long term. We are working to stabilize loads and revenues. And we will continue to exercise vigorous cost control.

We are hearing one clear message from our customers. Almost without exception, their top priority is stable and predictable rates. Our customers, as well as BPA managers, recognize that to achieve rate stability BPA must maintain strong, consistent financial performance. Our managers have adopted business tests to measure the success of our activities and performance. We have set goals for achieving consistent positive net revenues, stronger debt service coverage, and a lower ratio of fixed costs to revenues. Achieving these goals will assure positive cash flow and appropriate, timely payments to the Treasury, and will demonstrate that we are a reliable business partner.

REVENUE OUTLOOK

We are closely monitoring FY 1988 financial results with increasing concern, because of serious drought conditions for the second year in a row. Following poor Northwest water conditions in 1987—the 10th worst year in 61 years of record—the current year is shaping up to be even worse. Based upon early March snowpack readings, the annual Columbia River volume runoff is projected to be only 67 percent of average. This means it is likely that we will not achieve our objective of starting the next operating year with full reservoirs. Consequently, we are operating the power system in a conservative manner, foregoing nonfirm sales, utilizing storage arrangements with others, and purchasing some additional power. This situation will also have a serious effect on our FY 1989 revenues, but it is too early to assess the total revenue picture for FY 1989.

Because of the difficulty caused by our revenue swings, we incorporated 3 measures in the 1987 Rate Case to help mitigate the risks of undercollection. We expect that measures such as these will continue to be included, and possibly enhanced, in future rate cases. The measures are a conservative assumption regarding export revenues due to water conditions; an amount included in the revenue requirement to provide an average interest coverage ratio of 1.08 on interest payments to the Treasury; and a cost recovery adjustment clause [CRAC] in the rates to augment revenue for the last 9 months of FY 1989 if needed. The CRAC can be triggered by BPA if FY 1988 net revenues are approximately $45 million or more below planned levels. Our January forecast of power sales indicated that CRAC would not be triggered this year. Even with the worsening drought, we believe today that we can manage our way through this year and avoid the trigger. Still, nature, or some other force or circumstance—such as a lengthy, unscheduled outage of one of our generating projects—could yet deal us a further blow.

COMMITMENT TO COST CONTROL

During last year's rate process, BPA and its regional partners demonstrated a commitment to keep BPA's costs under control. As a result of a public process and through intensive management review, BPA cut planned FY 1988-89 spending by over $110 million from levels originally included in the revised FY 1988 Congressional Budget. Partly as a result of those cost reductions we were able to lower our rate increase for the FY 1988-89 period from a potential 13.1 percent in the initial rate proposal to just 7.7 percent.

The program cuts that took place during 1986-87 were made with input and encouragement from our customers and the region. We learned a great deal by expanding our review process, and as a consequence, early this year we initiated an annual public forum called "Programs in Perspective." Through this public process, BPA decisionmakers will regularly review major agency issues and program levels in the context of regional concerns.

BPA's ability to stabilize its rates depends not only on its own cost-cutting actions, but to a considerable extent upon other influences within and outside the region. Regional groups representing special interests should recognize that programs they support will undergo close scrutiny during this period of intense revenue pressure and competition. Entities such as the Corps of Engineers, the Bureau of Reclamation, the Washington Public Power Supply System, and Portland General Electric Company must exercise stringent control over the costs of their generating projects that feed into BPA's budget and rates.

As we curtail costs, we must carefully balance the fact that BPA is a Federal agency with unique responsibilities. Not the least of these is our responsibility to fund projects that mitigate the effects of the Columbia River Federal hydropower system on fish and wildlife in a manner consistent with the Northwest Power Planning Council's Fish and Wildlife Program.

Through BPA, regional ratepayers are currently contributing between $80 million and $140 million a year in fish and wildlife programs. (This includes BPA revenues foregone by providing for the accelerated streamflow of the "water budget," and by spilling water over some dams, timed to aid downstream fish migration.) The results of these expenditures, combined with other efforts in the region, are encouraging. Some runs of salmon and steelhead have increased to record highs in the last few years. In other stocks, the long-term downward trends appear to be flattening. We still face challenges, but we hope to extend the gains we have seen to more fishery areas during the next few years.

MARKETING INITIATIVES

Fortunately, higher than expected revenues from our Northwest aluminum customers are presently helping to offset the effects of the drought. This is largely due to marketing actions we told you about last year. To help Northwest aluminum companies remain competitive in the world market, we implemented a variable electricity rate that rises and falls with the market price of aluminum. All of BPA's aluminum producing customers are now purchasing power under this variable rate. This rate has been a clear success because it provided an incentive for the smelters to maintain stable levels of production, even when aluminum prices were down last year. In the current strong world aluminum market we are realizing revenues more than 40 percent higher than we projected in the rate case for these customers. We are, however, projecting a downturn in the world aluminum market during FY 1989.

Another action we have taken to help stabilize industrial loads is the conservation/modernization program for aluminum smelters, which was developed in 1987. All 10 Northwest aluminum smelters are now participating in this program, which should ultimately result in the reduction of about 175 average megawatts of power for the same aluminum production level. Under this program, BPA is paying about one-third (5 mills per kWh saved) of the total modernization costs, with an estimated cost to BPA of $76 million over a 10-year period. In addition to our investment, we expect that the aluminum industry will be investing an additional $200 million in plant modernization—a mutual commitment to load stabilization and the maintenance of important economic activity in this region.

I am also pleased to report that, after relatively flat load growth since 1980, sales to non-aluminum customers in the Pacific Northwest have begun to increase over the past year, signaling an upturn in the regional economy and higher employment levels.

Within the region we are developing and offering a number of consumer marketing programs aimed at maintaining loads in the short run. Collectively called the "Partnership Program," this effort involves rate incentives for displacement of wood heat, energy-efficient design assistance for new commercial buildings, technical guidance on energy-efficiency for industrial users, and incentives to help distressed industries facing imminent closure. While the immediate impact on revenues is not large, we believe the customer assistance these programs provide will help stabilize loads and revenues over the longer run.

Outside the region, surplus sales will be below planned levels because of the extremely low water conditions. Since last November we have restricted surplus firm energy sales to protect the reservoirs, as well as to meet the higher aluminum company loads. This situation has been further exacerbated by unplanned outages at Hanford Generating Project and Supply System Project Number 2. The resultant revenue losses could increase as we enter the spring and summer months when we usually export large blocks of power to California.

You may recall that the 1986 drop in oil and natural gas prices made petroleum-fueled power plants in California competitive—and eroded BPA's rates and power revenues in this market. During 1987, although the price of crude oil in the United States rose by about one-third, industrial users of natural gas saw their rates drop by an additional 12 percent. These and other factors have hampered our ability to conclude long-term surplus transactions, but small sales have been negotiated with the Cities of Burbank, Glendale, and Pasadena (known as the BGP sales). These sales are 20-year transactions which convert to capacity-for-energy exchanges when BPA reaches load/resource balance. We currently have several negotiations under way for further arrangements similar to the BGP sales.

In May of 1988, we will conclude the Long-Term Intertie Access Policy that has been in development for several years. The policy will facilitate a variety of long- and short-term transactions between utilities in the Pacific Northwest and the Pacific Southwest. We hope to strike a reasonable and sustainable balance among our obligations to repay Treasury investments, the needs of generating utilities in both regions, and the expectation of our ratepayers for low, stable rates. The policy will also establish a workable plan for protecting our present and future investments in fish and wildlife.

A related question is whether to provide increased non-Federal participation in intertie capacity. A study examining options for expanded non-Federal participation in the northern end of the 3rd AC Project was requested by Congress in June 1987. The options examined in the study were developed and analyzed with the assistance of a technical review panel that included a wide spectrum of interested groups with utility industry expertise in the Pacific Northwest and California.

FINANCIAL PLANNING

Most of BPA's annual expenses are fixed and cannot easily be reduced. This is largely due to our long-term debt, which grew rapidly between 1978 and 1982, when most of the bonds were issued for the Supply System projects. Our total power debt (excluding irrigation assistance) now stands at $14.5 billion ($8.4 billion for Federal debt and $6.1 billion for capitalized contracts, most of which is Supply System). Reducing the fixed costs associated with debt to increase our financial flexibility is a top priority.

Financial planning is already underway for FY 1990-91. The resultant program levels will receive keen scrutiny, with an eye toward reviewing the adequacy of our current rates for that period. We will evaluate the impact of new projects, replacements, and capital additions on our cash flow and net revenues. We expect that this will begin to constrain the growth of our debt and reduce the high proportion of our revenues that go to pay fixed costs. Our goal in the near-term is to retire debt at a greater rate than we incur new debt.

On money already borrowed, the challenge is to reduce interest payments. A large portion of the Supply System bonds were issued at rates substantially higher than current interest rates. About a year ago, a representative group of regional entities (including BPA and the Washington Public Power Supply System) began to investigate the feasibility of refinancing construction bonds issued for Supply System Nuclear Projects No. 1, 2, and 3. The financial and legal issues surrounding those bonds make the prospects of refinancing difficult. If these issues can be resolved, however, refinancing Supply System bonds, or pursuing other measures to reduce interest expense, could reduce debt service by $40–60 million per year by the late 1990's, given favorable market conditions.

UPDATED FY 1988 AND FY 1989 BUDGET ESTIMATES

Since this budget was prepared, there have been significant changes in the regional energy situation which will impact both fiscal years 1988 and 1989. I will bring you up to date on what that means for obligation levels in these 2 years.

- Hanford Generating Project [HGP]: As you know, continued operation of the N-Reactor at Hanford is not included in the President's Budget. This means the HGP, currently shut down for maintenance, is highly unlikely to restart, resulting in budget reductions of approximately $18 million in FY 1988 and $39 million in FY 1989. The unavailability of Hanford output may result in higher costs for replacement power, or in lost revenue from foregone sales, so the impact on our bottom line will be neutral or negative.
- I also want to let you know about a budget increase in the Conservation Program. When the FY 1989 budget was prepared, it was assumed that the incentive payments to builders and homeowners of new electrically heated homes that meet the Northwest Power Planning Council's Model Conservation Standards [MCS] would terminate in January 1989. This was based on the assumption that building codes equivalent to the MCS would be adopted throughout much of the region by that time.

However, it does not appear that, by the end of FY 1988, enough new code will be in place to warrant termination of our effort. It is our intention to continue working closely with the Northwest Power Planning Council, our utility customers, the four States, and local government units on joint strategies to achieve MCS-level building practice throughout the region. Energy savings from this kind of construction are easily the cheapest long-term response to future electric power needs. In fact, this is the principal resource in the Council's portfolio for meeting regional load growth. Therefore, after discussion with the Council, BPA has decided to continue incentive payments for homes built to the MCS past the end of FY 1988, until codes are passed or until higher MCS penetrations of the new housing market are achieved.

Since the first year of this increase impacts the budget year we are currently reviewing, I will take this opportunity to identify the need for additional borrowing of $10.2 million in FY 1989 for Energy Conservation. This would increase BPA's total FY 1989 borrowing from $136 million to $146.2 million.

CONCLUSION

In conclusion, I want to assure you that, barring uncontrollable events, we are positioned to keep rates stable, improve the financial condition of the agency and, most importantly, to make our Treasury payments in full and on time.

That concludes my prepared statement. I would be glad to answer questions from the committee.

BIOGRAPHICAL SKETCH

James J. Jura was sworn in as Bonneville Power Administrator July 18, 1986.

Mr. Jura was born December 9, 1942, in Creston, Nebraska. He first came to the Pacific Northwest in 1962 while serving in the U.S. Army.

After completing his military service, Mr. Jura earned a bachelor of arts degree and was graduated from the University of Washington in 1968. He received a master's degree in business administration from Seattle University in 1970.

Mr. Jura received his master's degree while working for the Boeing Company in Seattle in Boeing's commercial airplane division. Mr. Jura began his Federal career in 1971 with the Department of Labor's Occupational Safety and Health Administration [OSHA] in intergovernmental relations and program planning and evaluation.

He later spent 5 years with the Office of Management and Budget [OMB] in Washington, D.C. While at OMB he worked as a Budget Analyst and Legislative Analyst. For a time, he reported directly to the Director of OMB as his Special Assistant.

Mr. Jura was first employed by BPA as the Assistant Manager of its Washington, D.C. office in 1978. He moved to Portland, Oregon, in 1980 to take the position of Executive Assistant Administrator.

Mr. Jura served as a key member of the Administrator's office from 1980 to 1986. As Executive Assistant Administrator, he was responsible for BPA's internal management. He was involved in every major aspect of BPA's activities and was third in line of authority after the Administrator and Deputy Administrator.

Mr. Jura lives in Portland with his wife Frederika and their four children.

STATEMENT OF WILLIAM H. CLAGETT, ADMINISTRATOR, WESTERN AREA POWER ADMINISTRATION

Mr. Chairman and Members of the Subcommittee, I welcome the opportunity to appear before you to discuss the Western Area Power Administration's (Western) programs and accomplishments. We are grateful for the interest and support this Subcommittee has provided to us during our first 10 years as a Federal power marketing agency. That support has played a significant role in our success.

I am pleased to present the Administration's FY 1989 budget request, as Western begins a second decade of service to our customers with renewed commitment to operating and maintaining an efficient, economical, and reliable electrical system. Although this coming fiscal year will indeed be challenging, I am confident that our FY 1989 budget request will provide Western with the resources needed to meet those challenges. With your continued support, we should accomplish our objective of marketing Federal energy in such a manner as to encourage widespread use at the lowest possible rates to our consumers consistent with sound business principles.

WESTERN'S MISSION

As an electric power marketing administration, Western is responsible for the sale and delivery of power to nearly 600 wholesale customers. Our customers include municipalities, rural cooperatives, public utility districts, Federal and state agencies, irrigation districts, Federal reclamation projects, and investor-owned utilities. These wholesale power customers, in turn, provide electric service to millions of retail power consumers in the states of Arizona, California, Colorado, Iowa, Kansas, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Dakota, South Dakota, Texas, Utah, and Wyoming. Western's largest source of power revenue is from municipal utilities. Sales of power and transmission services to investor-owned utilities provide the second largest source of revenue.

In FY 1989, Western will be responsible for operating and maintaining 16,509 circuit miles of transmission line, 246 substations, two high voltage AC-DC-AC converter stations, and various appurtenant power facilities within a 1.3-million-square-mile, 15-state area. Western also constructs new transmission and substation facilities, as required. Electric power marketed by Western will be generated at 52 hydropower plants operated by the Bureau of Reclamation (BuRec), the U.S. Army Corps of Engineers (Corps), and the International Boundary and Water Commission, U.S. Section. In addition, Western will market any energy not required for project pumping from the Federal entitlement in the Navajo coal-fired plant near Page, Arizona. The maximum FY 1989 operating capability of all these powerplants, including the Federal share of the Navajo plant, is projected to be 10,536 megawatts. Western also purchases power to meet contractual requirements.

STATUS OF WATER CONDITIONS IN WESTERN'S MARKETING AREA

The major river basins in the Western United States are expected to generally produce below-normal flows during FY 1988. The current outlook is for below-normal runoff in California for the Sacramento, San Joaquin, and Trinity River Basins. Current reservoir storage in these basins is near normal. The Missouri River Basin and Colorado River Basin runoffs are also expected to be below normal, although current reservoir storage in these two basins is near normal. Assuming a continuation of this water supply picture for the remainder of this year, most of Western's hydropower facilities will have below-normal energy output. However, current reservoir storage supplemented by planned power purchases should be sufficient to allow Western to meet its power delivery requirements.

BUDGET HIGHLIGHTS

The FY 1989 appropriation request of $298.4 million for the construction, rehabilitation, operation and maintenance account is a decrease of $1.6 million from the FY 1988 program level. The program decrease is mainly attributable to implementation of reimbursable financing arrangements with our Federal customers. These reimbursable financing arrangements have reduced Western's

FY 1989 budget requests for Hoover Switchyard Consolidation work and for purchase power and wheeling expenses for the Central Valley Project (CVP) in California. These reductions are partially offset by increases in the construction and rehabilitation activity and in the costs of goods and services.

Although the program level shows a slight decrease, the FY 1989 appropriation request for the construction, rehabilitation, operation and maintenance account is $48.9 million higher than the FY 1988 appropriation. Congress assumed $50.5 million of unobligated FY 1987 appropriations would be available in FY 1988 and reduced Western's FY 1988 new budget authority request accordingly. The FY 1989 appropriation request assumes no unobligated carryover will be available, so the total FY 1989 program level is to be financed through new budget authority.

The personnel staffing level of 1,379 full-time equivalents requested in FY 1989 is the same as FY 1988.

The FY 1989 request of $84.0 million in obligational authority for the Colorado River Basins Power Marketing Fund (CRBPM Fund) is $3.0 million below FY 1988. This decrease is attributed to lower payments for interest on investment.

Specific appropriation or fund amounts requested in FY 1989 compared to the FY 1988 level are as follows:

BUDGET REQUEST SUMMARY
(Dollars in Thousands)

Appropriation or Fund/Activity	FY 1988	FY 1989 Request	Change
CONSTRUCTION, REHABILITATION, OPERATION AND MAINTENANCE			
Construction and Rehabilitation	$ 85,000	$ 94,252	+$ 9,252
System Operation and Maintenance	93,000	90,461	- 2,539
Purchase Power and Wheeling	122,000	113,700	- 8,300
SUBTOTAL (PROGRAM)	$300,000	$298,413	-$ 1,587
Use of planned unobligated balances (net)	- 50,485	0	+ 50,485
SUBTOTAL (BUDGET AUTHORITY), CONSTRUCTION, REHABILITATION, OPERATION AND MAINTENANCE	$249,515	$298,413	+$48,898
COLORADO RIVER BASINS POWER MARKETING FUND (OBLIGATIONAL LIMITATION)	87,000	84,000	- 3,000
TOTAL BUDGET REQUEST	$336,515	$382,413	+$45,898

CONSTRUCTION AND REHABILITATION

During FY 1987, work was completed on 8 substation additions, including the Sidney, Nebraska, Direct Current (DC) Converter Station, and approximately 570 miles of transmission line. In FY 1988, we plan to complete work on 12 substation additions, 7 communication site additions, 1 operation and maintenance building addition, and to reconductor, rebuild, or construct about 158 miles of transmission line.

The construction and rehabilitation program request for FY 1989 is $94.3 million. Of the $94.3 million, $43.8 million is to complete or continue work on 18 substation additions, 2 communication site additions, and 3 operation and maintenance building additions. We will also complete work on approximately 310 miles of transmission line.

Approximately $34.0 million is for new contract awards for 6 transmission lines, 27 substation additions, 1 communication site, and 3 operation and maintenance service center additions. Two of the 6 transmission lines, the

Charlie Creek-Belfield 345-kV transmission line (North Dakota) and the Lovell-North Cody-Big George 115-kV transmission line (Wyoming), involve new construction. The Charlie Creek-Belfield transmission project will improve system reliability and reduce operating restrictions by providing a necessary second high-voltage transmission path. The existing 40-year-old Lovell-North Cody-Big George line has deteriorated significantly.

Western will also continue joint participation in construction of the Craig-Bonanza 345-kV transmission project between the Craig Generating Station near Craig, Colorado and the Bonanza Generating Station near Bonanza, Utah.

Studies for Future Facilities

The balance of $16.5 million for the construction and rehabilitation program is to continue engineering analyses, land services, and environmental and planning studies. The analyses are required to ensure that Western continues to meet system capability needs, deliver firm power to customer loads, and explore mutually-beneficial transfers of power between adjacent systems or regions. Western coordinates and conducts most of its planning studies as joint efforts with other utility groups, because of the interdependence of the various electric utility systems. These groups presently consist of 2 regional reliability councils (Western Systems Coordinating Council and Mid-Continent Area Power Pool), 4 power pools, and over 25 different project study groups. Western's primary goal in pursuing joint study efforts is to coordinate the planning of Federal transmission system facilities with other area utilities. Joint participation increases overall system reliability and efficiency, lowers the cost of system operation and maintenance to participants, minimizes environmental impacts, and reduces the need for Federal appropriations.

The Second Pacific DC Project

In cooperation with other utilities, Western is continuing planning and developmental activities for a second Pacific DC project authorized in 1964, but not yet constructed. If built, each of the project phases would terminate in Western's Mead Substation in southern Nevada and would provide alternative transmission paths for the benefit of project participants. Developmental work for the Mead-Phoenix DC transmission line (Phase I), which involves Western, the Salt River Project, the Southern California Public Power Authority, and the M-S-R (representing the cities of Modesto, Santa Clara, and Redding, California) Public Power Agency as project participants, is nearly completed. The Mead-Adelanto DC transmission line (Phase II), which is managed by the City of Los Angeles, has a schedule parallel with the Mead-Phoenix Project. In addition, as part of the Mead-Northwest DC transmission line (Phase III), Western and other entities are reviewing planning agreements. Planning work on all three phases is expected to continue through FY 1989.

California-Oregon Transmission Project

Pre-construction activities on the Harold T. (Bizz) Johnson California-Pacific Northwest Intertie line, also referred to as the California-Oregon Transmission Project (COTP), are nearing completion. The COTP is an initiative of nearly all of the California private and public utilities to construct a third 500-kV AC transmission line between the Pacific Northwest and California to allow mutually-beneficial power sales between the two regions and to improve system reliability. The COTP, estimated to cost approximately $430 million, consists of a 346-mile-long transmission line from southern Oregon to central California and associated substations and communications facilities.

Western and the Transmission Agency of Northern California have completed the joint State of California Environmental Impact Report/Federal Environmental Impact Statement, and this document has been released to the public. A Federal Record of Decision on this project is expected by May 1988.

The three investor-owned utilities in California that are participating in the project, Pacific Gas and Electric, Southern California Edison, and San Diego Gas and Electric, have not yet received Certificates of Public Convenience and Necessity from the California Public Utilities Commission (CPUC). The three companies' applications were rejected twice by the CPUC staff and the companies appealed the second staff decision to the full Commission. On February 16, 1988, the Commission affirmed the staff decision, concluding that there is no clear definition of the COTP because there is no agreement among all the participants for wheeling power between central California and southern California. The CPUC approval has now become a critical item for moving ahead with the COTP since, even if the wheeling issue can be resolved within the next few months, it will take at least 6 additional months for the CPUC to process the companies' applications and issue certificates for the project. Start of construction will thus be delayed until the spring of 1989 with a projected completion date of 1992.

Phase-Shifting Transformers

Western has an ongoing project to install Phase-Shifting Transformers (PSTs) in western Colorado. The PSTs will help reduce serious unscheduled power flow problems, which cause loss of transmission capacity on two key transmission lines linking the northern and southern systems of the Colorado River Storage Project. The projected in-service date for the PSTs is early 1989.

OPERATION AND MAINTENANCE AND POWER MARKETING

For FY 1989, $90.5 million is requested for operation and maintenance activities in the construction, rehabilitation, operation and maintenance account. Of this amount, $75.6 million is requested for regular transmission system operation and maintenance expenses. This includes classified and wage board employee salaries, travel and transportation, rents, communications, utilities, materials and supplies, data processing, the inspection and treatment of wood poles, and administrative and general expenses.

In addition, $13.3 million is requested for power system replacements and additions that are necessary to maintain and improve system reliability, stability, and operational efficiency. This includes the purchase of circuit breakers, transformers, and telemetering, supervisory control, microwave, radio, and protective relaying equipment; the acquisition of new equipment to replace existing equipment containing polychlorinated biphenyls; and the replacement of deteriorated wood-pole transmission structures. Hoover Switchyard Consolidation activities that were partially financed through permanent budget authority in previous years are proposed to be financed through reimbursable arrangements with the BuRec starting in FY 1989.

Conservation and Renewable Energy

In FY 1989, $3.9 million is requested for the Conservation and Renewable Energy (C&RE) program (including activities totaling $2.4 million funded through the CRBPM Fund). The C&RE Program is designed to encourage Western's customers to develop and promulgate effective conservation and renewable energy projects which demonstrate responsible stewardship of natural resources.

Utah Power and Light Company Lawsuit

On October 31, 1986, the Utah Power and Light Company (UP&L) and 158 of its full-service customers filed suit in the United States District Court in Salt Lake City, Utah, challenging the preference provisions of Federal reclamation law, as well as certain of Western's other power marketing activities, including construction of the Craig-Bonanza transmission line, and Western's compliance with environmental laws. Western filed a Motion for Summary Judgment in March 1987. Extensive discovery was conducted by UP&L during the past summer and in September 1987, UP&L filed a three-volume response to Western's motion. Oral arguments on the Motion for Summary Judgment were heard on October 19, 1987. The resolution of this lawsuit potentially impacts all of Western's power marketing activities. The judge has not yet issued a decision on the motion.

Marketing Plan Status

In FY 1987, the power allocation process was completed for the Salt Lake City Area Integrated Projects, which include the Colorado River Storage Project, the Rio Grande Project, and the Collbran Project. Final power allocations were also made for the Parker-Davis Project and the combined resources of the Pick-Sloan Missouri Basin Program-Western Division and the Fryingpan-Arkansas Project. Western completed negotiations and executed contracts for the sale of power from the Boulder Canyon Project and began interim marketing of power from the Navajo Generating Station, in accordance with the Hoover Power Plant Act of 1984.

In FY 1988, we will complete contract negotiations for all projects where final allocations have been made. However, Western will not execute contracts for the sale of power from the Salt Lake City Area Integrated Projects until such action is permitted by a court decision in the Utah Power & Light Company litigation. Once additional features of the Central Arizona Project are completed, Western will market Navajo power in accordance with a long-term marketing plan adopted by the Secretary of the Interior in December 1987.

PURCHASE POWER AND WHEELING

The total request for FY 1989 purchase power and wheeling activities is $113.7 million. In addition, Western has credits from net billing ($23.7 million), bill crediting ($50.0 million), reimbursements from Federal customers ($37.4 million), and nonappropriation transfers

($15.1 million) which partially offset appropriation requirements. The program activity provides for the purchase and wheeling of power to meet existing contractual commitments, mostly in the CVP of California. The decrease of $8.3 million from the 1988 program level is primarily due to implementation in FY 1989 of reimbursable financing arrangements with Western's Federal CVP customers, which more than offsets the higher costs of energy and capacity purchases.

RATES, REVENUES, AND REPAYMENT

Status of Project Power Rate Adjustments

Western initiated rate adjustments during FY 1987 for the Salt Lake City Integrated Projects, the CVP, and the Boulder Canyon Project. For these projects, the rate adjustments are expected to result in a net decrease of about $7.0 million in annual revenues caused by the reduction in CVP power rates effective May 1, 1988. Rates for CVP power were increased in May 1983 in anticipation of rapidly escalating purchase power prices and to eliminate a revenue deficit that had accumulated because of expensive thermal power purchases during the previous 5 years. Since this deficit will be entirely repaid by April 1988, the CVP rate can be reduced and still repay the Federal investment in CVP facilities. In order to guard against a recurrence of the revenue deficit caused by variances between actual outlays and budgeted purchase power and wheeling expenses, the new rate includes an automatic revenue adjustment clause. Within certain defined limits, revenues will increase or decrease in proportion to fluctuations in purchase power and wheeling expenses.

In accordance with commitments made to Boulder Canyon Project contractors when the 1987 rate was filed, Western will file a new Boulder Canyon Project rate that reflects modified calculations, as mutually agreed to by Western and the contractors.

Although preliminary analyses indicate that rate adjustments may be needed for the Pacific Northwest-Pacific Southwest Project, the Parker-Davis Project, the Pick-Sloan Missouri Basin Program, and to blend rates for the

Fryingpan-Arkansas Project and Western Division of the Pick-Sloan Missouri Basin Program, initiation may be delayed pending completion this fiscal year of a study of improved financial practices. Western plans to work with the Office of Management and Budget to identify workable improvements to Power Marketing Administration financial practices. Improvements that will be considered include the possibility of creating and maintaining a "cushion" for revenue shortfalls. The treatment of construction work in progress in setting power rates and the use of financial performance indicators will also be considered.

Power Revenues and Energy Sales

Preliminary results for FY 1987 indicate that Western marketed 40.8 billion kilowatthours (kWh) of available energy to wholesale power customers and received power revenues of $637.0 million. Estimates for FY 1988 energy sales and revenues are 38.4 billion kWh and $650.5 million, respectively. For FY 1989, energy sales are estimated at 37.5 billion kWh and revenues are estimated at $619.2 million.

The forecasted energy sales decline after FY 1987 is primarily due to increases in pumping energy requirements for the Central Arizona Project of the Colorado River Basin Project, and assumed return to average water conditions in FY 1988. The projected decrease in revenues in FY 1989 results primarily from the rate decrease for the CVP and continued increased use of pumping energy for the Colorado River Basin Project.

As of September 30, 1987, the investment to be repaid by Western totaled approximately $5.0 billion, of which $2.1 billion has been repaid. Cumulative power receipts total $7.7 billion and have been applied as follows: $2.8 billion for operation and maintenance; $1.4 billion for purchase power and wheeling; $1.4 billion for interest; and $2.1 billion for repayment of investment in facilities and assistance to irrigation. In FY 1987, $204.0 million was applied to repayment of investment. To date, 42 percent of the investment assigned to power for repayment has been repaid.

The following table summarizes Western's repayment status by project:

STATUS OF REPAYMENT AS OF SEPTEMBER 30, 1987 (PRELIMINARY)
(DOLLARS IN MILLIONS)

Project Power System	Initial Year of Repayment Studies	Cumulative Power Revenues	Cumulative Exp. *	Power Investment**	Nonpower Investment to be Repaid by Power	Deferred Expense	Invest. Repaid to Date	Unpaid*** Bal. of Invest.
Boulder Canyon	1937	$ 646	$ 488	$ 363	$ 25	--	$ 158	$ 231
Central Valley	1944	1,852	1,638	432	62	$ 26	215	280
Collbran	1963	13	13	11	5	--	1	15
Colorado River Basin (Navajo)	1974	723	641	--	81	--	81	
Colorado River Storage	1963	1,371	814	736	650	--	557	829
Falcon-Amistad	1955	31	25	44	--	--	6	38
Fryingpan-Arkansas	1982	20	20	186	--	5	--	186
Pacific Northwest-Pacific Southwest Intertie 1/	1968	32	32	54	--	21	--	54
Parker-Davis	1942	444	251	149	27	--	193	<17>
Pick-Sloan Missouri Basin 2/	1950	2,498	1,633	1,566	568	--	865	1,268
Provo	1958	3	2	1	--	--	1	--
Rio Grande	1949	42	39	9	5	--	3	11
Washoe	1987	--	--	6	--	--	--	6
TOTAL		$7,675	$5,596	$3,557	$1,423	$ 52	$2,080	$2,901

* Cumulative Expenses includes operation and maintenance, purchased power, interest, and other costs paid from revenues.

** Power investment does not include Deferred Expense or repayment assistance to nonpower investment, primarily irrigation investment. Nonpower investment and Deferred Expenses are shown as separate columns.

*** Some totals may not add due to rounding.

1/ AC facilities only.

2/ Includes the four integrated projects (North Platte, Shoshone, Colorado-Big Thompson, and Kendrick).

This concludes my statement of Western's FY 1989 budget and program status. Mr. Chairman, I would be pleased to respond to any questions you or the Subcommittee members may have.

March 1988

BIOGRAPHICAL SKETCH

WILLIAM H. CLAGETT
Western Area Power Administration

William H. Clagett was appointed Administrator of the Western Area Power Administration (WAPA) by Secretary of Energy John S. Herrington on March 19, 1985. Clagett was the Deputy Administrator with WAPA from 1978 to 1984.

WAPA markets and transmits federally produced power in a 15-state area.

Clagett graduated from Oregon State University in 1962 with a Bachelor of Science Degree in Business and Technology. He began his Federal career with the Bonneville Power Administration (BPA) in Portland, Oregon, in 1962. In 1966, he was assigned to the Area Office of BPA in Idaho Falls, Idaho, as an electrical engineer and was named Area Manager in 1970. The following year, he was appointed Assistant Administrator at BPA and assigned to the Washington, D.C. Office. He remained with BPA until transferring to WAPA.

In 1984, Clagett served as Acting Administrator for the Southwestern Power Administration headquartered in Tulsa, Oklahoma.

Clagett has served in various capacities on the Western Systems Coordinating Council, including the position of Chairman. He currently serves as vice chairman of the North American Electric Reliability Council (NERC). The NERC is a voluntary organization formed by the electric utility industry to promote the reliability and adequacy of bulk power supply of the electric utility systems in North America.

Clagett and his wife, Brenda, reside in Littleton, Colorado.

STATEMENT OF HARRY C. GEISINGER, ADMINISTRATOR, SOUTHEASTERN POWER ADMINISTRATION

Mr. Chairman and Members of the Subcommittee:

I appreciate the opportunity to appear before you today to present the FY 1989 budget request for the Southeastern Power Administration (Southeastern) and to discuss Southeastern's program. I will summarize the major program areas of the request and discuss some of our accomplishments.

The Southeastern Power Administration, with headquarters in Elberton, Georgia, markets hydroelectric power from projects constructed and operated by the U. S. Army Corps of Engineers and located in 10 Southeastern states. Southeastern has no transmission lines and accomplishes the delivery of power by wheeling agreements with power utilities in the area that have the necessary transmission facilities.

Southeastern presently markets power from 22 multiple-purpose projects to 297 power purchasers. Estimated power revenues for FY 1989 are $145 million, reflecting the sale of 3,092 megawatts of installed capacity with 7.7 billion kilowatt-hours of energy.

Southeastern's overall repayment status is as follows: from inception in 1950 to September 30, 1987, operating revenues available for repayment totaled $1,461,660,000. These revenues were allocated to payment of $630,032,000 of annual operating expenses, $520,698,000 of interest expense, and $310,930,000 of capital investment in electric plant. The total capital plant on September 30, 1987, of $1,405,793,000, less the amount repaid, leaves a balance of $1,094,863,000 to be repaid.

FY 1989 BUDGET

A funding level of $36,267,000 is requested in the President's 1989 Budget to effectively carry out Southeastern's mission. The FY 1989 program level request represents an increase of $8,867,000 over the amount appropriated for the current year.

A comparison by activities of the FY 1989 Operations and Maintenance budget request with the amounts available in FY 1988 is as follows:

	FY 1988	FY 1989	Difference
System Operation and Maintenance	$ 2,104,000	$ 2,647,000	+$ 543,000
Purchase Power and Wheeling Charges	25,296,000	33,620,000	+8,324,000
Total New Budget Authority	$27,400,000	$36,267,000	$+8,867,000

SYSTEM OPERATION AND MAINTENANCE

The request of $2,647,000 for the System Operation and Maintenance activity will provide funds for the negotiation and administration of wheeling and power sales contracts; development and review of rates to assure repayment of power costs; scheduling the generation of power and supervision of power deliveries; and direction and support of Southeastern's power marketing program. This amount represents a $543,000 increase over the amount available in the current year.

The major portion of the request for this activity provides funding for personnel compensation and related costs and reflects the continuation of the current manpower level of 40 full-time equivalents. The request provides for increases resulting from statutory within-grade and Performance Management Recognition System increases, terminal leave payments, additional personnel benefit costs, and higher administrative costs for support functions.

The request also provides funding for a new computer system to replace the computer system, initially installed in May 1982, which is currently operating at its peak capacity.

PURCHASE POWER AND WHEELING

The major portion of the budget request, $33,620,000, is required for the Purchase Power and Wheeling activity and represents an increase of $8,324,000 over the amount available in the current year. The increase is required for payment of transmission services under contracted arrangement.

Funds provided for this activity are used to pay amounts charged the Government under contractual arrangements for (1) delivery of power over non-Federal systems to load centers of preference customers for the account of the Government, (2) purchase by the Government of energy, if necessary, during adverse water periods, and (3) support capacity required to meet commitments for the Jim Woodruff Project under adverse water conditions.

In the absence of ownership or operation of transmission facilities, Southeastern carries out its marketing program by utilizing the existing transmission systems of the power utilities within its marketing area. This is accomplished through wheeling arrangements between Southeastern and each of the area utilities that have transmission lines connected to the projects, under which the utility agrees to deliver specified amounts of Federal power to customers of the Government and Southeastern agrees to compensate the utility for the transmission service performed.

Southeastern has been deeply involved in the development and implementation of power marketing policies for its respective systems which will ultimately allow all available Southeastern power, both capacity and energy, to be marketed to preference customers. These policies have been implemented as new contracts were executed for the respective marketing areas.

Contracts providing for the sale of all power to both existing and new preference customers which are expected to be in effect during FY 1989 cover the following Southeastern sales:

1. that portion of the power produced in the Georgia-Alabama System which is marketed within the service areas of South Carolina Public Service Authority, South Carolina Electric & Gas Company, Duke Power Company, and the operating utilities of the Southern Company (Georgia, Alabama Gulf, and Mississippi Power Companies).

2. that portion of the power produced in the Cumberland System which is wheeled outside the Tennessee Valley Authority (TVA) service area as well as that portion to be sold within the TVA service area, and that portion designated to be marketed in the Kentucky Utilities service area.

3. all power produced in the Kerr-Philpott System which is marketed in the Appalachian Power Company, Virginia Power, and Carolina Power & Light Company service areas.

4. power produced at the Jim Woodruff Project and sold in the Florida Power Corporation service area.

With respect to that portion of the power produced in the Georgia-Alabama System and sold in the Southern Company service area (Georgia, Alabama, Mississippi, and the panhandle of Florida), wheeling charges will be handled, to the extent possible, by net billing with the affected utilities during this period. Decreasing quantities of capacity will be sold to the utilities through May 1991, and charges to the utilities for this capacity will be used to offset charges by the utilities for transmission services provided. During FY 1989, increased funding will be required for payment of transmission services under these contractual arrangements, since capacity sales to the utilities will be insufficient to fully net bill the charges for transmission services provided by the utilities.

Additionally, purchase power and wheeling funds are required under the provisions of existing contracts for the sale of power produced at the Jim Woodruff project.

STUDY OF DIVESTITURE OF SEPA

Legislation has been introduced that would allow the Department of Energy to study the possible divestiture of the Southeastern Power. The objectives of the proposed study would be to assess the feasibility of divestiture of Southeastern including the identification and analysis of divestiture alternatives that are responsive to regional and customer needs, without causing significant increases in power rates. In undertaking the proposed study, if authorized by Congress, the Department of Energy would consult with all interested parties, including Southeastern's existing power customers, or their designated representatives, and TVA, concerning Southeastern's four systems of projects. The Department would identify potential customer and regional impacts, as well as possible impacts on TVA, as part of the consultation and study process. The results of any such study would be reported to the Congress and no implementation of divestiture would begin without subsequent Congressional authorizations. Should Congress allow the proposed study, it would be our intent to fund it from separate appropriations. Its cost should not be charged to Southeastern's customers.

POWER SYSTEMS

Southeastern's projects are grouped for marketing purposes into four financially independent systems. The power systems, customer locations, and status of wholesale rate adjustments are hereinafter discussed. Southeastern has accomplished all of its recent rate adjustments with a minimum of difficulty.

GEORGIA-ALABAMA SYSTEM

The Georgia-Alabama System is comprised of the Allatoona, Buford, Carters, J. Strom Thurmond (formerly Clarks Hill), Walter F. George, Hartwell, Robert F. Henry, Millers Ferry, Richard B. Russell, and West Point projects. Two of the four units at Carters are pump-generator units. Power from the system is sold to customers located in Georgia, Alabama, North and South Carolina, Mississippi, and Florida. Power rates for this system, applicable through September 30, 1990, were approved by the Federal Energy Regulatory Commission on July 22, 1986.

The four pump-generator units at the Richard B. Russell Project, which will provide an additional nameplate capacity of 300,000 kilowatts, are scheduled to begin operation during 1990.

CUMBERLAND SYSTEM

The Cumberland System includes the Wolf Creek, Center Hill, Dale Hollow, Old Hickory, Cheatham, Barkley, J. Percy Priest, Cordell Hull and Laurel projects. The projects are located on the Cumberland River, or its tributaries, and are located in northern Tennessee and southern Kentucky.

System power is marketed to customers located in Tennessee and in portions of Mississippi, Kentucky, Alabama, Georgia, Illinois, and North Carolina. Power rates, applicable through June 30, 1989, were approved by the Federal Energy Regulatory Commission on a final basis on December 27, 1984. On January 20, 1987, the Commission approved an amended rate schedule for the customers located in the western service area of the Carolina Power & Light Company for the period September 1, 1986, through June 30, 1989.

During FY 1989, a formal rate submission will be submitted to the Federal Energy Regulatory Commission for the Cumberland System for the period July 1, 1989, through June 30, 1994.

KERR-PHILPOTT SYSTEM

Power from the John H. Kerr and Philpott projects, located in the Roanoke

River Basin in Virginia, is marketed to customers in Virginia and North Carolina. Power rates for this system, applicable through September 30, 1991, were approved on a final basis by the Federal Energy Regulatory Commission on January 23, 1987.

JIM WOODRUFF SYSTEM

The Jim Woodruff Project is located on the Apalachicola River on the Georgia-Florida state line. All dependable capacity available at the Project is sold to preferred customers in peninsular Florida. Revised power rates for the Jim Woodruff Project applicable from August 20, 1987, through August 19, 1992, were approved on a final basis by the Federal Energy Regulatory Commission on September 11, 1987.

LOW FLOW CONDITIONS AND ENERGY PURCHASES

The summer and fall of 1987 saw a return of the drought conditions which have plagued the 10-project Georgia-Alabama System and the 1-project Jim Woodruff System for several consecutive years. Rainfall deficiencies of 10 to 18 inches for the year were not uncommon. The lack of runoff and a greatly reduced base flow caused many streams to establish all-time-record lows during the late summer and fall. On November 19, 1987, as a result of Corps of Engineers' generating restrictions and in order to avert defaulting on Southeastern's contractual commitments, Southeastern began the purchase of energy from area utilities to replace a portion of its contract energy requirements, thus reducing actual project generation.

Purchases of replacement energy were suspended on December 18, following an improvement in the overall energy-in-storage conditions of the reservoirs. During this 6-week period, Southeastern purchased 39,479 megawatt-hours at a cost of $884,000. Purchases of replacement energy did not become necessary in the other systems.

Increased rain activity has brought about some recovery in the system; however, continued near normal rainfall is needed during the winter and spring to fully recover at the larger storage projects like Buford, Hartwell, and J. Strom Thurmond. The decade of the 1980's has brought a series of unprecedented droughts across the Georgia-Alabama System with streams flowing much lower than normal.

POWER MARKETING POLICY IMPLEMENTATION

Long-term contractual arrangements implementing the Cumberland System Power Marketing Policy have been negotiated and placed into effect with TVA, benefiting 160 preference customers within the TVA service area, and with preference customers in portions of Mississippi, Kentucky, Illinois, and North Carolina.

The Cumberland Policy also provides for the sale of Cumberland power to public bodies and cooperatives located in the Kentucky Utilities Company service area. Negotiations of a wheeling contract with the utility system as well as marketing contracts with the affected preference customers are being pursued. Long-term arrangements have been placed in operation for the western portion of the Georgia-Alabama System implementing the Georgia-Alabama System Power Marketing Policy. Contracts have been executed with the operating utilities of the Southern Company (Georgia, Alabama, Mississippi, and Gulf Power Companies) and preference customers in their service areas. Under these arrangements, the conversion to the policy of ultimately marketing all power to preference customers will be phased in by June 1991.

After May 31, 1989, the contracts allow the transfer of wheeling for Government power from company wheeling to preference customer wheeling at the discretion of the Government and the preference customers. The preference customers have expressed an interest in taking over part of these wheeling functions. Studies are being conducted to determine financial feasibility and logistics for such a transfer.

Long-term contracts have been placed in operation with South Carolina Public Service Authority, Duke Power Company, South Carolina Electric & Gas Company, and preference agencies within their service areas covering the marketing of power produced in the Georgia-Alabama System and sold in the eastern portion of that System.

The four pump-generator units at the Richard B. Russell Project are scheduled to be tested in November 1990 (FY 1991). Negotiations are expected to begin late in 1989 or early 1990 to develop contracts for the provision of pumping energy, backup, and other logistical functions necessary to the pumping operation, and for the marketing of this extra capacity in the Georgia-Alabama System.

Long-term contracts have been placed in operation with Virginia Power, Carolina Power & Light Company, Appalachian Power Company, and preference entities within their service areas to implement the Kerr-Philpott Power Marketing Policy.

LITIGATION

Last April Southeastern brought to close over six years of litigation involving its marketing policies with ElectriCities of North Carolina, Inc., and Greenwood Utility Commission of Mississippi by dismissal of the ElectriCities II suit in the United States District Court in Raleigh. The litigation resulted in favorable rulings in three Court of Appeals opinions and one district court opinion, strengthening Southeastern's authority and discretion to formulate and implement power marketing policies and allocate preference power pursuant to the Flood Control Act of 1944.

Currently there is no litigation pending against Southeastern.

This concludes my statement, Mr. Chairman, and I would be happy to answer any questions that you may have.

HARRY C. GEISINGER
Administrator
Southeastern Power Administration
U. S. Department of Energy

Biographical Sketch

Harry C. Geisinger became the fifth Administrator of the Southeastern Power Administration in November 1981, having been appointed to that post by the Secretary of Energy. As Administrator, he is responsible for directing all programs of a federal regional power authority, including power marketing, operation, maintenance, and administrative management. Southeastern transmits and disposes of surplus electric power generated at Federal reservoir projects in ten Southeastern states. The Administration sets the lowest possible rates to consumers, consistent with sound business practices. His responsibilities also include the negotiation, preparation, execution and administration of contracts for the disposition of electric power to all classes of utilities.

Mr. Geisinger also serves as a member of the Executive Board of the Southeastern Electric Reliability Council, and as a member of the Executive Committee of the Virginia-Carolinas Reliability Council. He is the recipient of the Department of Energy Meritorious Service Award.

He served as a member of the Georgia House of Representatives for three consecutive terms, 1968 to 1974, and was the Republican candidate for Governor in 1974.

He has participated in community activities, including the Doraville Jaycees; Atlanta Boy Scout Council; served as President and Chairman of the Board of the DeKalb County American Cancer Society from 1972 to 1974; Chairman of the Board of the Georgia State Soccer Association, 1984-1987; and President of the Georgia Youth Soccer Association, 1979-1980.

STATEMENT OF ROBERT J. CROSS, ADMINISTRATOR, ALASKA POWER ADMINISTRATION

The Alaska Power Administration is proposing a budget of $3,279,000 for FY 1989, and requesting $3,159,000 in new appropriations with the balance to be funded from FY 1987 deferrals.

The request would continue full funding for APA's operations, maintenance, transmission, and power marketing programs for the Eklutna and Snettisham hydroelectric projects.

FY 1987 - 1988 ACTIVITIES

It is a pleasure to report another successful year for our programs.

Progress is satisfactory on the maintenance activities and the project facilities are in excellent condition.

The program to modernize and automate the Eklutna powerplant is complete and the new supervisory control system is operating well. The operations and monitoring are now handled remotely from a utility dispatch center in Anchorage. The automation permitted a reduction in our total staffing from 38 to 35 FTE.

Other Eklutna Project completions include replacement of the concrete headwall at the tailrace and installation of new metering equipment at the plant. We expect delivery this spring of the replacement turbine runner which we ordered in September, 1986.

We are exploring possibilities of contracting out the transmission line maintenance at Eklutna to customer utilities. If this proves feasible, the contract maintenance could begin as soon as FY 1989. This is a comparatively minor activity amounting to about 10% of Eklutna operating expenses. Any savings will be reflected in reduced appropriations requests in the future.

Construction on Anchorage's new Eklutna municipal water supply project is essentially complete, with start up scheduled for May of this year.

We have a contract underway for removal of PCB transformers at each project, with the work to be completed this year. At Snettisham, we plan to replace and upgrade the existing powerline carrier communication system this year.

Also at Snettisham, the Corps of Engineers construction work on the Crater Lake Unit is now well past the mid-point. The power production date slipped several months because of problems with the turbine supply contract. The Corps has indicated they expect power production to begin from the new unit in February 1989, with construction to be completed in FY 1990.

Coordination of the Corps' construction activities and APA's operation and maintenance work has been effective, with minimal disruption to project operations.

We encountered no serious operating problems since our last report to you. The $200,000 emergency fund which was appropriated in 1984 remains intact.

Generally favorable cost experience is reflected in the $120,000 in FY 1987 funds available for deferral and application to our FY 1989 requirements.

Our FY 1987 gross revenues were $8,303,393, which is another record high for us. The revenues were sufficient to cover annual O&M and interest expenses and provide $2.1 million towards repayment. Similar results are expected in FY 1988.

NET BILLING

We now have net billing arrangements for three activities. These are operations contracts at Eklutna and Snettisham and wheeling of Snettisham power over non-Federal transmission lines. Total amounts net billed in FY 1987 were $203,000, and the estimated amounts for FY 1988 are $208,000.

We would also net bill the costs for the Eklutna transmission maintenance, if that work is contracted out. We expect that annual costs for this work will be on the order of $50,000.

DIVESTITURE

Work towards the sale of Eklutna and Snettisham Projects continues. A year ago we had just completed the second round of public review and comment on divestiture issues and plans, and we were ready to start the process of inviting purchase proposals.

We now have a proposal for each project and are in the process of negotiating conditional purchase agreements which would become the basis for legislation authorizing the sales.

The process has taken longer than we expected, but we believe we are much closer now to workable sale arrangements which will be fair to the seller, the purchaser, and the consumers. We believe we will have the proposals ready for Congressional consideration within a few months.

FY 1989 REQUEST

Our proposed budget of $3,279,000 is 3% above the FY 1988 amount, but slightly below the FY 1987 budget.

The request will provide full funding for the operations, maintenance, transmission, and marketing work.

The most significant new items for FY 1989 are replacement of 115kv circuit breakers, initial funding for replacement of the generator windings, and repairs to an access tunnel at Eklutna.

The existing circuit breakers have been in service since 1955. They do not perform well in cold weather and this performance problem becomes more serious with the unmanned operation. The new breakers are estimated to cost $250,000. This will be routine procurement.

The existing generator windings will reach their normal service life of 35 years in 1990. Condition tests in 1985 indicated some deterioration of the insulation on one unit, but that a few more years of useful service could be expected. We plan additional tests of insulation conditions this summer. Results will help determine the actual replacement schedule.

The challenge here is to get in position to install new windings before failure of the original windings. At least two years lead time is needed for fabrication, delivery, and installation. Our request puts us in a position to complete the replacement in 1991, if this year's tests show that schedule is necessary.

The new generator windings are expected to cost about $1,500,000, of which $254,000 is included in the FY 1989 request.

The tunnel repairs involve a 500 foot long adit which provides access to the Eklutna surge tank and power tunnel. Deteriorating rock in the adit poses a safety hazard which will be eliminated by installing a new liner or one of several measures to stabilize the tunnel. Current estimates indicate repair costs will be somewhat under $200,000.

We will continue our close cooperation with the Corps of Engineers on the Crater Lake unit and are prepared to take over operation of the unit as soon as testing is completed.

I believe the request would continue an appropriate level of funding for the APA programs to assure continuation of the excellent service record of the two projects.

February 1988

Biographical Notes--Robert J. Cross
Administrator, Alaska Power Administration
Department of Energy

Mr. Cross was appointed Administrator of the Alaska Power Administration in June 1976. He has been on the Alaska Power Administration (APA) staff since the Agency was formed in 1967. He was a staff engineer in the APA Planning Division between 1967 and 1973, and Planning Division Chief from 1973 to 1976.

Mr. Cross entered Federal Service in 1956 as a hydraulic engineer with the Bureau of Reclamation. Between 1956 and 1967, he had planning assignments with Reclamation in Colorado, Wyoming, Nebraska, and Alaska with a 2-year break for active service in the U.S. Army.

Mr. Cross is 54, and a native of Lincoln, Nebraska. He attended public schools in the states of Nebraska, Washington, and New York, and is a Civil Engineering graduate from the University of Colorado. Cross has been a resident of Juneau, Alaska, since October 1964.

STATEMENT OF RONALD H. WILKERSON, ADMINISTRATOR, SOUTHWESTERN POWER ADMINISTRATION

Mr. Chairman and Members of the Subcommittee:

It is a pleasure to present the Southwestern Power Administration's (SWPA) budget request for fiscal year 1989. A few summary statistics provide a broad outline of SWPA's request.

	FY 1988	FY 1989	Difference
Total Budget Program	$36,659,000	$36,430,000	$ -229,000
Reimbursable Authority	-6,346,000	-7,841,000	-1,495,000
Total Budget Request	$30,313,000	$28,589,000	$-1,724,000
Available Prior Year Balances	-13,665,000	-13,200,000	+ 465,000
Budget Authority (Appro.)	$16,648,000	$15,389,000	$-1,259,000

The proposed total budget request shows an overall reduction of $1,724,000 or 6 percent. SWPA's initiatives to use non-Federal funds through reimbursable authority reduce the total budget program by $7,841,000 or 21.5 percent. Also the need for budget authority has been reduced by $1,259,000 or 8 percent. The overall reduction of appropriations totalling $21,041,000 was achieved through the elimination of duplicate appropriations for SWPA and other Government agencies of $4,411,000, the use of non-Federal funds of $3,430,000, and the carryover of prior year funds of $13,200,000. The SWPA service area experienced the fourth straight year of generous rainfall in FY 1987, which was effectively utilized by significantly reduce the need for power purchases. SWPA's FY 1989 appropriation request will allow us to continue an efficient and effective program.

MISSION/STAFFING

Southwestern Power Administration (headquartered in Tulsa, Oklahoma) markets hydroelectric power generated at Federal dams, at the lowest possible rates consistent with sound business principles, giving preference in the sale to public bodies and cooperatives. SWPA schedules the operation of the Corps of Engineers' generating facilities for optimum resource utilization. SWPA designs, constructs, and operates its transmission facilities in a safe, reliable manner, consistent with good utility practice. SWPA facilitates the development of environmentally clean, renewable resources and energy conservation practices. In carrying out its mission, SWPA conducts business in an open manner with customers, employees, the Department of Energy, the Congress, and the general public.

The requested FY 1989 staffing level is 186 FTE, the same as FY 1988.

FY 1989 BUDGET INFORMATION

SWPA's budget is subdivided into three general activities: (1) Purchase Power and Wheeling, (2) Operations and Maintenance, and (3) Construction.

	FY 1988	FY 1989	Change
Purchase Power and Wheeling	$15,813,000	$14,777,000	$-1,036,000
Operations and Maintenance	13,137,000	14,815,000	+1,678,000
Construction	7,709,000	6,838,000	- 871,000
Total Budget	$36,659,000	$36,430,000	$- 229,000

I will summarize the pertinent information in each of these activities.

(1) Purchase Power and Wheeling

This activity provides for the funding of energy purchases necessary to meet the Government's power sales contract commitments to utility customers. The proposed $14,777,000 budget for purchase power and wheeling costs is a reduction from FY 1988 of $1,036,000, due to SWPA's continuing conversion of high-energy contracts to low-energy peaking-power contracts. The budget amount includes $7,936,000 for direct program activity and $6,841,000 of reimbursement authority as explained later in my statement.

(2) Operations and Maintenance

This activity provides for the funding of 186 FTE, their work in the areas of power marketing, operation of the transmission system, maintenance of all physical facilities, and general program management. The proposed $14,815,000 budget for operations and maintenance costs is an increase of $1,678,000. The increases are primarily in the areas of service contracts, $665,000; built-in increases for pay and benefits, $840,000; and miscellaneous expenses, $173,000.

(3) Construction

This activity provides for the construction or modification of new or existing transmission, substation, and switching facilities.

The proposed $6,838,000 budget for construction is a reduction of $871,000, and includes $5,838,000 for direct program activity and $1,000,000 of reimbursement authority as explained later in my statement.

CURRENT FINANCIAL STATUS

I am pleased to report to this subcommittee that SWPA is in good financial condition. All available power is under contract and is widely distributed among the six state region served by SWPA. Our hydroelectric energy production experienced the third consecutive year of above-average energy generation and produced revenues in excess of $90,832,000. For the sixth straight year, SWPA has maintained a positive repayment status. The results of FY 1987 operations made $20,737,000 available for repayment, of which $6,783,000 was used to offset prior year cost adjustments due to the application of final allocation rates for seven hydroelectric projects.

SWPA's cumulative repayment is $143,588,000 on a total repayable investment of $882,770,000 or 16.3 percent.

RATES

Timely rate increases have helped SWPA maintain its good financial standing. SWPA's current integrated system rates are effective through September 30, 1989. However, pursuant to SWPA's policy of making an annual rate review to assure a positive repayment posture, a rate filing is under preparation. An estimated 3 percent increase in the integrated system rates and an estimated 5.8 percent increase in the Sam Rayburn Dam rate will likely be requested. The rate proposals will be submitted to the Under Secretary of Energy and to the Federal Energy Regulatory Commission, with the new rates to become effective May 1, 1988.

REIMBURSABLE AUTHORITY

SWPA's initiatives to reduce its need for appropriated funds through the use of reimbursable authority have been focused in two areas, Federal and non-Federal.

The level of reimbursable authority requested for FY 1989 is $7,841,000, an increase over the FY 1988 request of $1,495,000. Of the total requested, $6,841,000 is for Purchase Power and Wheeling. The Federal portion ($4,411,000) of this amount provides for the elimination of duplicate appropriations requested by both SWPA and by the Department of Defense military installations, and the non-Federal portion ($2,430,000) is to be received from SWPA's various Oklahoma municipal customers. The remaining $1,000,000 is for additions and modifications to transmission lines, substations, and electronic facilities, and will come from various SWPA utility custumers. This activity, to be performed by SWPA, will improve and upgrade our facilities presently in need of improvement, by utilizing non-Federal funds to provide adequate capacity and more reliable service.

In the past, such power purchases for the military installations, the Oklahoma municipal customers, and the power system improvements were made with appropriated funds and the expenditures were reimbursed to SWPA by the Department of Defense and utility customers and deposited with the Treasury as miscellaneous receipts. Under the proposed reimbursable authority, SWPA will be able to continue to provide services and accommodate customer required enhancements of SWPA's system by direct use of other Federal and non-Federal funds.

HYDROELECTRIC POWER ACTIVITIES

SWPA's significant hydroelectric power activities are:

(1) Non-Federal Financing Activities

SWPA continues to facilitate non-Federal financing of Federal hydropower projects. Construction of the Town Bluff Hydroelectric Power Project began in 1987, is on schedule, and should be completed in June 1989. As a result of the enactment of Public Law 99-662, we are working with the Cherokee Nation of Oklahoma on the development of the W.D. Mayo Hydroelectric Power Project on the Arkansas River in eastern Oklahoma and with the Grand River Dam Authority (GRDA) on the development of units five and six at Fort Gibson Dam on the Grand River in Oklahoma.

The Cherokee Nation, the U.S. Army Corps of Engineers (Corps), and SWPA are in the developmental stage of the three party construction agreement which will be executed if the project is determined to be feasible. Draft construction, escrow, and power marketing agreements have been developed between GRDA and SWPA for construction of units five and six at Fort Gibson Dam. All of these agreements are anticipated to be signed during the fourth quarter of FY 1988.

SWPA has been approached by existing and new preference customers regarding the development of other potential hydroelectric power projects in the region. Such projects are in various stages of planning and would be fully designed and constructed with non-Federal funds provided during or prior to the start of construction.

(2) Harry S. Truman 5-Unit Testing

The Corps has moved one step closer to full hydroelectric power generation at the Harry S. Truman Project in Missouri. From December 1987 through February 8, 1988, the Corps and SWPA tested the use of five generating units. The Corps indicated that no major negative impacts have been reported to date. However, we are still restricted to using four units until such time as the Corps has finalized their studies on the recently completed five unit tests.

(3) Denison Dam Management Plan

SWPA is working closely with the Corps to develop the Denison Dam Management Plan as set forth in the Urgent Supplemental Appropriations Act of 1987, Public Law 100-71.

DISPATCHERS PAY

The passage of Public Law 100-71 provided for our power system operators to be paid wages comparable to those prevailing in the utility industry. This new law allowed us to recruit and hire three well-qualified system dispatchers in the last six months. These positions are vital to the safe operation of our system and for the reliable delivery of our power to the regional communities.

CLOSING

In conclusion, Mr. Chairman, SWPA has again taken initiatives to reduce appropriation requests. SWPA's dynamic program is committed to maintaining a good financial condition and to operating in an open business-like manner. SWPA is proposing rate increases in order to assure that sufficient revenues are generated to return to the U.S. Treasury all operating expenses, interest, and principal associated with the power generating and transmission facilities of the Southwestern Federal Power System.

We appreciate the cooperation and recognition provided by the members of this committee. I am privileged to serve as Administrator and to work with your committee and with the customers and employees of SWPA.

BIOGRAPHY

RONALD H. WILKERSON

Ronald H. Wilkerson was appointed Administrator of Southwestern Power Administration (SWPA) on July 29, 1984, by the Secretary of Energy.

Headquartered in Tulsa, Oklahoma, SWPA is a regional agency of the U.S. Department of Energy (DOE) with responsibility for marketing Federal hydroelectric power in Kansas, Missouri, Oklahoma, Arkansas, eastern Texas, and Louisiana. SWPA has power sales agreements with 12 electric cooperatives, four government agencies, and 45 municipal electric utilities.

As Administrator, Wilkerson is responsible for marketing the output of 23 Federal hydroelectric projects at the lowest possible cost while fully repaying the Federal investment with interest. These projects have installed capacity of 2,200 megawatts and generate an average of 5.5 billion kilowatthours of energy annually. Sale of power produces revenue of approximately $100 million annually against a budget of $38 million.

With about 190 employees at five locations, SWPA operates and maintains 1,380 miles of transmission lines and 24 substations in addition to scheduling and dispatching the power.

Prior to his appointment, Wilkerson was Manager of the Upper Columbia Area for the Bonneville Power Administration (BPA), a regional power marketing agency under DOE in the Pacific Northwest. He was responsible for BPA activities in eastern Washington, northern Idaho, and western Montana.

Arriving at BPA in 1961, Wilkerson progressively held more responsible positions within that organization resulting in extensive experience and expertise in the areas of customer service, power marketing, and engineering. This included serving as BPA District Manager in Kalispell, Montana, as well as assignments in Idaho Falls, Idaho; Seattle and Walla Walla, Washington; and The Dalles and Portland, Oregon.

Wilkerson is a Registered Professional Engineer, a member of the Institute of Electrical and Electronic Engineers, and serves on the Board of Directors of the Southwest Power Pool. He has received numerous awards for special acts and performance. A native of Montana, he received his Electrical Engineering degree from Montana State University.

Wilkerson and his wife, Sharon, have three sons and a daughter.

January 1988

OVERVIEW OF BPA OPERATIONS

Mr. JURA. Thank you, Senator Hatfield.

It is a pleasure to come before you again and present the Bonneville Power Administration's fiscal year 1989 budget.

Briefly, I would like to provide you with an overview of the Bonneville situation, including the drought situation that we are encountering this year, and the goals we are pursuing.

Since I last appeared before you, we completed our rates process for fiscal years 1988 and 1989. In this process we and our customers demonstrated a commitment to keep BPA's costs and rates under control while assuring our ability to meet our Treasury repayment obligations. Satisfying our responsibilities to the U.S. Treasury is our top priority.

Through an intensive cost-cutting effort we reduced our planned spending for fiscal years 1987 through 1989 by more than $1 billion. As a result of this interaction between us and our customers, we were able to hold our priority firm rate increase to an average of 7.7 percent.

Included in that rate package are a number of revenue protection measures. One of these provides a debt service coverage ratio on interest payments to the Treasury, which is designed to assure that we can make that payment.

Another revenue protection measure is the cost recovery adjustment clause that would allow a limited rate hike for 1989, if unexpected events adversely impact our revenues.

DROUGHT CONDITIONS AND IMPACT

This conservative planning that we adopted in our last rate case may be a fiscal salvation during the coming year. The Pacific Northwest is well into its second year of a severe dry spell. Based upon the thin snowpack and the lowest August-to-March stream flows on record, the annual runoff of the Columbia River is projected to be at least one-third below normal this summer.

At this time we are projecting that no major hydroelectric reservoirs, except the reservoir behind Grand Cooley Dam, will refill by the end of our operating year.

A prolonged drought could cost BPA hundreds of millions of dollars. Since last November we have taken the precaution of restricting surplus firm energy sales to protect our reservior levels, and our revenues have suffered accordingly. These losses could multiply as we enter the summer months, when we normally export large amounts of power to California. Anything less than early and heavy snowpack next winter will make the situation worse.

MARKETING STRATEGIES

Even without the drought, Bonneville has good reason to streamline its operations, balance its program priorities, and impose stringent controls on spending. The U.S. electric utility industry is very competitive and it is appropriate that Bonneville mount an aggressive marketing program based on low, stable rates.

We are pursuing two general strategies in marketing our power. The first is to protect and enhance our Northwest loads. For our aluminum customers, we initiated variable rates in 1986 that are tied to the price of world aluminum. This helped stabilize production during a period of low demand.

One year ago when I appeared before your committee, the price of aluminum was in the 60-cent range. Today it is selling for over $1. The aluminum market that we are experiencing at the present time is very beneficial to our revenue situation; in fact, it is the bright spot in our revenue picture.

We have also developed regional marketing programs with the intent of maintaining BPA and utility revenues, promoting energy conservation, and stimulating the business economy in the Northwest. To date there is promise of meeting all three of these criteria.

With regard to the California market, we are developing a long-term intertie access policy that will facilitate and bring certainty to long-term transactions between utilities in the Northwest and in California.

In that policy, we hope to strike a reasonable balance among our ability to meet our Treasury payments, the needs of generating utilities, and our ratepayers' concerns for low, stable rates. The policy, which will be concluded this May, will also establish a workable plan for protecting our fish and wildlife resources.

REPAYMENT STATUS

I am pleased to report that BPA is continuing to meet its obligations to the Federal Treasury in full and on time. For fiscal years 1988 and 1989, we plan to pay $1.3 billion, while only using $300 million of new borrowing authority. Over the 2-year period, we will provide a net inflow to the Treasury of approximately $1 billion.

Since its inception, Bonneville has repayed more than $5 billion in interest and amortization on the taxpayers' investment in the Federal Columbia River Power System.

Bonneville's 1989 budget contains no major new initiatives. We have been able to hold our planned obligations to less than 3 percent above current year levels. This is a competitive budget to suit these competitive times, and like competition itself, our budget is directed to improve our ability to provide improved electric service at reasonable rates.

Thank you for hearing my remarks and I am prepared to answer any of your questions.

THIRD A.C. INTERTIE

Senator HATFIELD. Thank you very much.

Mr. Jura, I am aware of the administration's position on withholding BPA borrowing authority for the Third A.C. Intertie. I want to go into a series of questions relating to that. I will be seeing the Director of the OMB a little bit later this morning, and I appreciate the fact that you are here as an administration spokesman and it is not my intention to put you in an untenable position, but I do want to establish for the record with some clarity what has happened here.

So, first, may I ask the basic question: Has the borrowing authority for BPA's part of this project been deleted in both fiscal year 1988 and fiscal year 1989?

Mr. JURA. Yes, sir.

Senator HATFIELD. Some level of funding may be requested after you have finished a study of potential nonfederal participation in the BPA portion of the line?

Mr. JURA. Yes, sir.

Senator HATFIELD. Has that study been completed?

Mr. JURA. Yes; we completed it and it was delivered to the Congress last Friday.

Senator HATFIELD. Does the study make a conclusion or a recommendation as to the desirable level of nonfederal participation in the line?

Mr. JURA. No, sir; the study outlines the alternatives that are available to us as we consider that question. That was the task, as we saw it, that we were asked to do. We also, in communicating the study, have advised the Congress that we expect to move ahead now to that question and that it would take us approximately 6 months. We think we can do the necessary analysis to come up with a proposal within 6 months.

Senator HATFIELD. If the final recommendation is anything other than the arrangement that we in the Congress have approved for the last 2 years, how long would it be before you could actually begin the first phase of construction on the line?

Mr. JURA. If we go through the participation study and we conclude the full federal participation, as our current environmental work now assumes, we could move ahead.

Senator HATFIELD. You wouldn't have to supplement your environmental impact statement?

Mr. JURA. That is correct. The environmental work we are doing on the project now assumes that condition.

On the other hand, if the study caused us to select another option, we would be required to amend the environmental work.

Senator HATFIELD. I believe the existing environmental statement does contemplate federal ownership and control of the BPA part of the line, does it not?

Mr. JURA. Yes, sir.

Senator HATFIELD. When will that work be completed?

Mr. JURA. We expect to have that work completed by mid-April.

Senator HATFIELD. If you have the access to borrowing authority that would have to be pre-1988–89, I guess, could you begin the construction steps at that time?

Mr. JURA. Yes; we could. After we complete the IUD-EIS in mid-April we would have a 30-day waiting period and we could begin after that.

Senator HATFIELD. You could proceed on the nonfederal participation before a line is placed in service, could you not?

Mr. JURA. Yes, sir; we could proceed with both of those issues in parallel.

Senator HATFIELD. I appreciate your responding because the record that we are building here this morning, I think, has very important bearing not only on this Third A.C. line but on the future activity of Bonneville itself. It appears to me that these facts that you have, once again, establish very clearly that there is no reason whatsoever to delay the construction of this line. I would like now to get to some of the more fundamental issues that we have to deal with.

BORROWING AUTHORITY

First of all, again, within the context that will have some reference to the borrowing, I am aware that the current proposal on this intertie is an OMB proposal; correct?

Mr. JURA. Yes, sir.

Senator HATFIELD. I am most disturbed by what I view as a possible abuse of authority here, on which I will not ask you to comment.

Are you familiar with the legislative history in 1974; I believe Secretary Udall appeared before the committee on the Federal Columbia River Transmission Act?

Mr. JURA. Yes, sir.

Senator HATFIELD. Are you aware, Mr. Jura, that the basic premise of that act, which granted self-financing authority to Bonneville Power, was to remove Bonneville as a federal business enterprise from the vagaries of the annual appropriations process?

Mr. JURA. Yes.

Senator HATFIELD. More specifically, Mr. Jura, the Congress was concerned at that time that the federal government, acting through BPA, would be a reliable business partner to both its utility customers in the Pacific Northwest and also its business partners outside the Northwest.

The BPA fund in the U.S. Treasury, coupled with the borrowing authority, were designed to allow BPA the financial flexibility and stability to enter into multiyear projects with reasonable assurance of completion of those projects, with ultimate repayment by the electric rate payers receiving the benefit of those projects.

Mr. Jura, does BPA have business partners in this line?

Mr. JURA. Yes, sir. In the northern portion of the line, the planned Third A.C. line anticipates an upgrade of existing facilities that are presently jointly owned by three northwestern utilities—Bonneville, PP&L, and Portland General Electric.

Senator HATFIELD. About how many utilities are involved in the southern portion of this line in total?

Mr. JURA. In the total, an additional 25 or so utilities are participating in California as well.

Senator HATFIELD. So, we have almost 30 other business partners in total.

Regardless of any technical or financial merits of this line, the federal government has been made an unstable—I would interpret it as unstable—business partner, despite the clear intent of the Congress to the contrary.

It appears that OMB is not only inhibiting the energy capabilities of the Northwest region, but also now the entire west coast, because of the scope of the project.

I am not expecting you to comment on these remarks, but in 1980 the Congress passed the Northwest Regional Power Act, which expanded the role of BPA and created new borrowing authority to carry out the purpose of the act for BPA.

Let me ask you, Mr. Jura, are the fish and wildlife conservation and renewable resource programs equally at risk in the future?

Mr. JURA. At this time, we have no indication that they are at risk.

Senator HATFIELD. But, could they be?

Mr. JURA. Yes, sir.

Senator HATFIELD. Can OMB restrict your ability to obligate cash from revenues as well as restrict your borrowing authority?

Mr. JURA. We don't believe that they can, but that is the current issue that we have under discussion with OMB.

Senator HATFIELD. So, then the budgets for the BPA programs agreed to by the Congress and as envisioned under the Regional Power Act, such as conservation, fish and wildlife, and renewable resources, can be at risk as well?

Mr. JURA. Again, sir, they could be, but at this time we have no indication that there would be any problem in that area.

Senator HATFIELD. But they could be?

Mr. JURA. Yes, sir.

Senator HATFIELD. I believe, Mr. Jura, that this situation has to be rectified and it seems that the OMB has taken a position which allows itself the line-item veto in BPA's business. I do not believe that was the intent of Congress, nor do I believe it is the intent of Congress now. I believe it is a situation badly in need of repair and I am sure we will have further discussions on the matter.

Are you working with OMB to rectify this situation?

Mr. JURA. Yes, sir; we are. We have been meeting with them for a number of weeks now. In fact, we have staff from Portland in town this week to meet with them tomorrow.

These are difficult issues. There are legal issues involved as well as practical issues. The discussions have been open and good discussions. At this point, I am pleased with the way the discussions are going and we plan to continue them. We have a high priority on this.

Senator HATFIELD. I am, first of all, pleased with the response to that question. Particularly, Mr. Jura, I urge you to continue to hold these meetings and attempt to work out this situation with OMB and I would like to be kept informed on the progress of these discussions.

In turn, I will keep you informed on the progress that I will be making from my perspective and position, because this is something that the longer it continues the more difficult it might become to correct.

MODEL CONSERVATION STANDARDS

Let me now turn to another subject, if I could, a somewhat happier note.

I see that you are amending your budget to include additional borrowing authority for the Model Conservation Program. Would you explain to us a little further as to what change will occur?

Mr. JURA. That is correct, sir. We will be requesting additional borrowing authority to continue the Model Conservation Standards Program.

Three years ago, the Regional Council and Bonneville anticipated that by the end of fiscal year 1988 we would have reached penetration levels in acquiring model conservation standards through our Super Good Cents conservation program and through early adopters support programs for changes in building codes, so that we would have a very good chance to have in place statewide codes equal to the model conservation standards.

For a number of reasons, that did not occur and, in recent months, we have been having an active debate within the region as to whether or not these incentive payments, particularly incentives for the model conservation standards associated with early adopters, should continue.

We have had a public involvement process at Bonneville where we have asked all parties in the region and outside the region to comment on alternative ways of approaching this. We have had in-depth discussion with the Regional Council and I am pleased to tell you that we have reached agreement that there are good reasons to continue this program.

Now that we have had some experience with the program, we are making some necessary and appropriate changes and I believe the changes are valid. We believe the model conservation standards opportunities are appropriate for us to go after.

We believe that the adoption of statewide energy codes is the most efficient way and the least costly way of doing that. When a utility achieves these savings they are benefitted, and we believe it appropriate that the benefiting utility participate in the cost of the program.

In recent weeks, we have reached agreement on this and we are now proceeding to move ahead together to get these codes into place.

Senator HATFIELD. Have you found any problem in the communication and understanding of the model conservation standards you have been working on?

Mr. JURA. What I found as we examined this issue was that we do not have the understanding across the region that we need to have if we are to accomplish the savings through statewide energy codes.

I believe there is much more Bonneville can do. I believe there is much more the utilities who are served by Bonneville can do within their respective states to work with the state legislatures to better inform the legislators of the need for the codes.

I think the Regional Council has been doing an excellent job in this area, and we need to come together and help them.

Senator HATFIELD. Do you have the basic support now of all members of the Northwest Power Council on the agreement?

Mr. JURA. Yes, sir; it is my understanding we have that.

DROUGHT CONDITIONS AND IMPACTS

Senator HATFIELD. You were mentioning the drought and the consequences of that. Would you spell out for us and explain—afterward, I want to get into the Mitchell Act problem—how downstream migration, particularly, will be affected by your projected drought and the dangers of providing the necessary flows?

Mr. JURA. The drought condition brings, as you know, problems to many sectors, and with the conditions that we are presently experiencing, where our stream flows are approximately 67 percent of average, and the snow-pack is in the neighborhood of 72 to 73 percent of normal, in addition to the current low flows we have, we are expecting a very dry summer.

We have, as you would expect, competing interests for the water—the agricultural users, the fish users, the power users, recreation, transportation. It is a very difficult situation. I am pleased to report that we have been working closely with all of those parties and we have the benefit of a highly coordinated and well coordinated system available to us, so that we can work out these issues to do what is best for each of these interests.

With respect to fish and wildlife, we are moving to meet all of our commitments that we have made to the fish and wildlife interests. This will require us taking specific actions that will have a revenue impact.

For example, we are now currently purchasing water to help us meet the water budget that we have agreed, with fish and wildlife interests, is necessary throughout the year.

We are moving to take those actions, and at this time I anticipate we will be able to meet our commitments.

MITCHELL ACT AND FISHING RESOURCES

Senator HATFIELD. Mr. Jura, would you briefly describe the Mitchell Act as it relates to the fisheries in the Northwest for the record?

Mr. JURA. It is my understanding that the Mitchell Act is based on recognition of the tremendous benefit that hatcheries in the states of Washington and Oregon can have to fishery production and to the fish harvest.

Over the years, the U.S. Government has seen the benefit of funding these hatcheries to enhance the production levels and we have seen dramatic increases in the production of the fish harvest.

In recent years, as the budget pressures have increased, there has been a continuing debate between the executive and the Congress as to whether or not this funding should continue and at what level.

There has been significant attention paid to whether or not the responsibility to fund this operation should be shifted to the regional ratepayer, and to what extent costs can be shifted from the U.S. taxpayer.

We are very concerned this year with the action that will be taken by the federal agencies in this area, and we are currently assessing whether or not Bonneville has the authority to fund some of the activities that could be cut back by the federal agencies.

Senator HATFIELD. In approximately what year was the Mitchell Act passed, do you recall the period, the decade?

Mr. JURA. I don't have that off the top of my head.

About 1938.

Senator HATFIELD. So, we recognized this federal role almost before Bonneville existed?

Mr. JURA. Yes, sir.

Senator HATFIELD. When Bonneville came into being, it was a further emphasis on maintaining that enhancement of the fisheries due to the possible losses from the placement of a dam in the river and subsequent rivers.

Mr. JURA. Yes, sir.

Senator HATFIELD. Now, on top of that, you have a projected drought—not a projected one, one we have been in, but a more severe drought in the off year—so that, if anything, it would be a greater demand to uphold this contract. In effect through the statute to continue the enhancement program under the Mitchell Act, and other fishery concerns that we address through other different methods.

Would you not agree to that generalization?

Mr. JURA. Yes, sir.

Senator HATFIELD. To break it down to specifics, we are looking at fiscal year 1989 when NOAA is proposing to reassess all of this in a way to reconfigure their budget to eliminate the fisheries program, or at least to severely reduce it to a further low.

But, without it being in reference to NOAA, you would feel that, if anything, we should be increasing our resources, I would suppose, based upon the projected weather rather than diminishing those resources to enhance the fisheries, would you not?

Mr. JURA. Yes, sir; that is the issue that we are struggling with at the moment.

Senator HATFIELD. I appreciate your making the record on that, too, because we will be discussing this matter with the new Director, who may be confirmed later this week based on the hearings that have been held, and we will get his views about how to handle the allocation of funds within his agency.

Thank you very much.

ADDITIONAL PREPARED QUESTIONS SUBMITTED FOR THE RECORD

I also have some questions from Senator Johnston for the other Power Marketing Administrations that I will not go into today, but rather will place in the record for their response.

INTRODUCTION OF ASSOCIATES

I have only one other request and that is to introduce your colleagues who have accompanied you, so that we can recognize them,and to commend all of you for a remarkable outstanding record of administration.

Mr. JURA. Thank you, sir.

Directly behind me I have Steve Ailshie, Bonneville's financial manager. Seated next to Steve is Roger Seifert from our Washington, DC, office, who is our financial expert. Seated next to Steve is Jack Robertson, the Deputy Administrator of the agency.

Senator HATFIELD. Excuse me, what was that last name? [Laughter.]

Mr. JURA. Jack Robertson. [Laughter.]

Seated next to Jack is Lee Johnson, the head of our Washington, DC, office.

Senator HATFIELD. I thank you. We are very happy to have all of you here this morning.

Do you have anything further to add to the record?

Mr. JURA. No, sir.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR JOHNSTON

Alaska Power Administration Sale

The Alaska Power Administration plans to initiate a program to replace the generator windings at the Eklutna project over the next 3 years.

Question: Is that a pre-condition to the sale of the Alaska Power Administration?

Answer: No, this is not a pre-condition of the sale. Our premise is that we need to provide for necessary replacements until the actual sale decision is made. We think the request is a reasonable insurance measure. If the on-going monitoring program indicates the replacements can be deferred, the funds would not be spent.

Question: Would there be any impact on the sale proposal if this work was not initiated?

Answer: We would expect an impact only if we experience failure of the existing windings before we are prepared to replace them.

Question: Would there be any adverse impact of operations if this would be deferred?

Answer: Again, there would be adverse impacts if the existing windings fail before the replacements are ready.

Southeastern Power Administration

Question: What specifically makes up the increase budgeted for the other services?

Answer: Primarily, the increase consists of purchase power and wheeling requirements of $8,324,000.

Question: The justification material summary shows an increase of $385,000 for automated data processing and information systems. Could you explain this in more detail?

Answer: To accomplish Southeastern's mission within available resources, automation of all activities is essential, whenever possible. Southeastern's present computer system is a mini-computer system, originally installed in May 1982, with the primary purpose of processing power bills and performing word processing functions. The system has been upgraded several times to meet the minimum need to automate additional functions. The mini-system has served Southeastern well. Due to the phenomenal growth in the usage of the computer system, the additional demand upon the system has outgrown the system's memory and storage capability.

The benefits to be derived from a modern computer system with advanced technology capabilities are to improve productivity, relieve computer resource performance constraints, perform large engineering studies, better utilize off-the-shelf software, upgrade usable data base, improve management information, and provide end users a more timely computer environment reducing menial tasks, etc.

The goal is to acquire a cost-efficient modern computer system, integrating a core of personal computers as end user work stations, with capabilities sufficient to support Southeastern's automated data, information, and data telecommunications systems processing requirements.

The computer system will have the capability to process other agencies' developed software, off-the-shelf software, the Government's standardized systems software, and be compatible with other power marketing agencies' computer systems to the maximum extent feasible. This will allow Southeastern to take advantage of cross-servicing arrangements and off-the-shelf software.

The computer system will be an integrated system with capacity to process accounting, repayment, operating, billing, budget, engineering, manpower, and personnel data and studies. The system will be composed of personal computer systems, work stations and terminals integrated through upgrading the telephone system to function as a local area network and utilize a mini computer for computing capacity and large data storage capability.

The proposed system will have sufficient memory and storage to significantly improve the efficiency and effectiveness of automating activities supporting Southeastern's mission. The system will support Southeastern's data base, billing, accounting, engineering, and administrative automated activities. There are constraints within the present computer system which limit increased productivity and performance in these key areas.

Question: The object class summary reflects equipment requirements going from $70,000 in 1988 to $510,000 in 1989. What specifically accounts for this large increase?

Answer: The increase is primarily due to an automated data processing system in the amount of $385,000 and miscellaneous office equipment of $55,000.

Richard B. Russell Project

Question: The Committee continues to be concerned with the situation at the Richard B. Russell project which will likely impact the operations of the pumped storage units.

Question: Briefly, what is the current situation at Russell?

Answer: The Corps of Engineers advertised for the Construction General Contract (concrete work, etc.) on February 18, 1988. The bids are scheduled to be opened on March 31, 1988. The contracts for the pump-turbine and generator-motors have previously been awarded and the units are now in the process of being fabricated. The Stone and Webster engineering firm is under contract with the Savannah

District, Corps of Engineers, and have subcontracted to the Waterways Experiment Station at Vicksburg to run model tests using various fish protection devices.

The Corps published in the Federal Register (Vol. 53, No. 32, 4872, Feb. 18, 1988) an intent to prepare a Supplemental Environmental Impact Statement for pump storage regarding fish protection at the Russell Project. The model tests at the Waterways Experiment Station are scheduled to be performed during the month of April.

The scheduled completion dates for the four pumped storage units are: January, April, July, and October of 1990. Testing of the units in the pump mode is scheduled to begin in November 1990.

Question: How do you assess the problem and what impact would there be if the pumped storage units were prohibited from operating?

Answer: In the event that the Richard B. Russell pump units are never allowed to operate, rates will be required to increase to a greater extent than if the units operated because 300 megawatts of capacity will not be available for sale.

Question: In your opinion, how likely is it that the pumped storage units will be operated as designed?

Answer: Based on information we have at the present time, we believe that a satisfactory fish protection device will be developed which would permit the pump storage units to operate as designed.

Harry S. Truman Project

Briefly review the background and current status of the problems associated with the pumped storage units at the Harry S. Truman project.

Question: Do you think the pumped storage will operate as designed?

Answer: No, it cannot operate as originally designed; however, some modifications may allow the pumped storage operation to be used.

Question: What is the potential impact on Southwestern's rate and revenue situation?

Answer: The potential impact on Southwestern, due to the loss of the pumped storage operation, could result in the loss of revenue and customer benefits. Without a reduction in the cost allocated to hydroelectric generation, these lost revenues of approximately $3.2 million will ultimately have to be overcome with a rate increase of about 5% to our customers. However, the impact on SWPA's customers who must replace SWPA's renewable capacity and energy resources with non-renewable generation is even greater, and is estimated at $28.9 million.

Question: Are there operational options which could lessen the impact?

Answer: Yes, to some extent the planned generating capacity at Harry S. Truman could be achieved without pump back if additional storage were to be allocated to power in the Harry S. Truman reservoir.

Another potential remedy is being investigated by one of Southwestern's customers. Associated Electric Cooperative, Inc. is funding a study by the University of Missouri at Rolla to test the feasibility of using a porous rock dike in the tailwater area to alleviate the problem. If successful, this would allow the use of the pump back operation.

Western Area Power Administration

Question: I note that WAPA plans to implement a reimbursable financing arrangement with Federal customers which is estimated to result in a net reduction of $8,300,000 for Purchase Power and Wheeling in 1989. Will legislation be required to implement these financing arrangements? If so, what is the status and schedule for obtaining the needed authority?

Answer: Legislation is not required to implement reimbursable financing arrangements with Federal customers. The Economy Act provides Western Area Power Administration authority to enter into reimbursable financing arrangements with other Federal entities who are power customers of Western. In addition to reimbursable financing arrangements, Western also uses customer bill crediting, net billing with power customers who are also power suppliers, and nonappropriation transfers with the Bonneville Power Administration to reduce annual appropriation requests. For example, in FY 1989, Western's appropriation request would be $126 million higher without these alternative financing arrangements.

Question: What is the current water situation in WAPA?

Answer: Below normal flows in the major river basins in Western's marketing area are expected during FY 1988. The current outlook, as of March 1, 1988, is for much below normal runoff in California for the Sacramento, San Joaquin, and Trinity River Basins. Current reservoir storage in California is near normal. The forecast for the Missouri River Basin ranges from below average in Montana to near average in Colorado. Colorado River Basin runoff is expected to be slightly below normal. Current reservoir storage in the Missouri and Colorado basins is generally average. Assuming a continuation of this water supply picture for the remainder of this year, most of Western's hydropower facilities will have below normal energy output. However, current reservoir storage supplemented by planned power purchases should be sufficient to allow Western to meet its power delivery requirements.

Question: What is the current status of construction of the Tracy-Livermore intertie?

Answer: Western has completed all preconstruction activities and is proceeding with construction of the Tracy-Livermore line as requested by the Department of Energy's San Francisco Operations Office. On March 25, 1988, a contract was awarded for construction of the line, and on-site work will begin this summer after right-of-way easements have been obtained. Contract awards for the substation work and equipment purchases will also be made this year. The line should be in service by late 1989.

Question: The budget includes $21.8 million to begin construction on three new transmission line projects. What is the total cost of these projects (Charlie Creek-Belfield, Lovell-North Cody-Big George, and Seminoe-Kortes)?

Answer: The total estimated cost for these three projects is $35.3 million. This includes $19.4 million for the Charlie Creek-Belfield line, $8.6 million for the Seminoe-Kortes line, and $7.3 million for the Lovell-North Cody-Big George line.

Question: How much would be needed to complete these projects in future years?

Answer: A total of $8.4 million is needed to complete these projects in future years. The Charlie Creek-Belfield line will require $6.8 million, the Seminoe-Kortes line will require $1.1 million, and the Lovell-North Cody-Big George line will require $0.5 million in FY 1990 and FY 1991.

Question: How much is included in the budget for each and what construction award date does the budgeted amount assume?

Answer: The FY 1989 budget request includes $9.6 million for the Charlie Creek-Belfield line, $6.5 million for the Lovell-North Cody-Big George line, and $5.7 million for the Seminoe-Kortes line. The FY 1989 budget request assumes a construction award of February 1989 for the Charlie Creek-Belfield line, July 1989 for the Lovell-North Cody-Big George line, and April 1989 for the Seminoe-Kortes line.

Question: What is the WAPA's current schedule for construction award?

Answer: Western's current schedule for construction award for the Charlie Creek-Belfield line is February 1989. The Lovell-North Cody-Big George line award is scheduled for July 1989, and the award for the Seminoe-Kortes line is planned for April 1989.

SUBCOMMITTEE RECESS

Senator **Hatfield**. The subcommittee will stand in recess subject to the call of the chairman.

[Whereupon, at 10:36 a.m. Monday, March 28, the subcommittee was recessed to reconvene at 10 a.m. Monday, April 11.]

ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1989

MONDAY, MAY 16, 1988

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 2:32 p.m. in room SD–192, Dirksen Senate Office Building, Hon. Jim Sasser presiding.

Present: Senators Sasser and Cochran.

TENNESSEE VALLEY AUTHORITY

STATEMENT OF MARVIN RUNYON, CHAIRMAN

OPENING REMARKS

Senator SASSER. The subcommittee will come to order.

This afternoon we are continuing our hearings on the fiscal year 1989 budget requests, and today we have before us the Tennessee Valley Authority. We are particularly pleased to have with us this afternoon the new Chairman of the Board of the Tennessee Authority, Mr. Marvin Runyon, who is joined by his fellow Directors Charles Dean and John Waters.

Gentlemen, we welcome you before the committee. This is no new experience for Mr. Dean and Mr. Waters. This is, I believe, your maiden voyage before the Energy and Water Development Subcommittee of the Senate, Mr. Runyon, and we are delighted to have you here.

Let me just take a few moments with some remarks before you present your testimony.

The hearings today take place during a time of great change at the TVA. Mr. Runyon, as the new Chairman, has moved swiftly to implement changes that he feels will address the problems of the agency.

Just 2 weeks ago, Chairman Runyon announced a plan to freeze TVA power rates for a 3-year period and eliminate the current $300 million deficit in the power budget. I have praised the goals expressed in an announcement as both ambitious and commendable. It is clearly in the best interest of the people of the Tennessee Valley to have low, competitive electricity rates.

I also noted at the time of the Chairman's announcement that it is too early really to evaluate at that time the details of Chairman Runyon's plan, but I hope today that we can discuss some of the details, and then we can explore ways to minimize the negative impact of the layoffs and other cost cutting measures that may be necessary to keep electrical rates level in the Tennessee Valley area.

TVA is more than just a utility company; it is the heart of the region's economy. The agency simply must seek ways to avoid economic upheaval to communities and to avoid the personal financial devastation of its employees. The actions that this Board takes are not taken in a vacuum. The changes that Chairman Runyon and his colleagues on the Board will make have repercussions throughout the Tennessee Valley area.

Gentlemen, I hope that you will proceed with a somber recognition that what you do affects the lives of literally tens of millions of people in the Southeastern region of the United States.

The root of many of the problems that have made this dramatic move by the TVA necessary, as we all know, is the troubled nuclear program. I must say to you that I have been greatly encouraged by the good news that has come out of the nuclear program recently.

I understand that the technical problems at Sequoyah have been taken care of, and just last Friday unit 2 went on line and is operating at about 35 percent of capacity. I applaud the efforts at Sequoyah and I am confident that this Board is doing everything possible to get TVA nuclear program generating power once again.

I might say to you that the suspicion, anxiety, and the negative publicity that has surrounded TVA's nuclear program has hurt the credibility of the agency's natural resource management programs, and these programs are funded with nonpower dollars by the Congress.

I have long believed that these programs must be the centerpiece of TVA's primary mission if it is to live up to its statutory obligation to promote the economic development of the Tennessee Valley area.

While all of TVA's natural resource management programs are important, the problems that are caused by the unprecedented 4-year long drought have highlighted the need to expand TVA's water quality programs. I reminded the Board at last year's of my strong interest in seeing the Tennessee Valley Authority adjust its priorities to put a greater emphasis on managing water quality and I look forward to hearing today the new Chairman's thoughts about this vitally important agenda.

The Tennessee Valley Authority must, at the very least, maintain its efforts in resource management and economic development. It is now working with a budget that has been reduced by over 50 percent during the 8 years of this administration. This year, the President proposes a further cut of 25 percent from last year's budget.

Nobody ever said that the Tennessee Valley Authority should not take its fair share of the cuts during a time of fiscal austerity, but the TVA has taken its fair share of the cuts and more. I intend to work very hard here in the U.S. Senate this year to see that TVA's budget is at least as large in 1989 as it was in 1988.

We all share the same goal—to return the Tennessee Valley Authority to the luster of its glory years when it was a model for public works programs not only across this nation but all across the world, when it was visited by the leaders of other nations, particularly by the leaders of the emerging nations, and viewed as a model of economic development and power production that they wished to take home with them. Today's hearing will explore ways to help achieve the goal of return TVA to its days of glory of the past.

Gentlemen, we have the defense authorization bill on the floor of the Senate. Unhappily there are going to be a series of votes this afternoon and the first one just started, which is the reason that some of our other Senators are not here. I am going to run to the floor and vote very quickly, and I will be back here in less than 10 minutes, and then we will get underway. Hopefully, we can proceed uninterrupted from that point. Thank you.

The subcommittee will stand in recess.

[A brief recess was taken.]

Senator SASSER. Gentlemen, we will turn now to the testimony of the Chairman of the Tennessee Valley Authority, Mr. Marvin Runyon.

Mr. Runyon, you may proceed as you choose.

TESTIMONY OF MARVIN RUNYON

Mr. RUNYON. Thank you very much, Mr. Chairman.

I appreciate the opportunity to appear before you today to present the administration's fiscal year 1989 budget request for TVA.

Before discussing the specific elements of the budget, it may be helpful to the subcommittee for me to review several matters of interest.

REVIEW OF TVA OPERATIONS

Since becoming Chairman, I have been involved in an extensive examination and review of all aspects of TVA's operations. I have talked with more than 10,000 TVA employees and met with business, community, and elected officials throughout the region. I have also studied the TVA's past performance and future plans. I have discussed my findings with my colleagues on the Board and TVA's newly formed Management Committee.

We recently spent 2½ days working together as a team to chart three objectives for TVA.

Our first objective is to operate a more competitive power system by holding our firm power rates constant for 3 years. This means no rate increases. Our second objective is to provide better services to the people of the region from federally funded programs by reducing overhead costs. Our third objective is to establish a more businesslike organization and focus it on efficiency, productivity, and accountability.

To reach these objectives, we will have to reduce personnel, cut overhead costs, limit the scope of some of our activities as a power system, and organize ourselves in a more businesslike manner.

We are working to turn TVA into a model of quality and productivity in business and government. Put quite simply, we are committed to demonstrating that a government-owned corporation can compete in terms of quality and productivity with any company in America.

IMPACT OF CURRENT DROUGHT CONDITIONS

Let me now turn to one resource issue of particular concern to members of this subcommittee and to TVA. That issue is the impact of the 4-year drought that is holding our region in its grip.

Over the past 4 years, rainfall in the Tennessee Valley has been about 57 inches below what is normal for that period. In other words, we have a rainfall deficit that is the equivalent of an entire year without rain.

The results can be seen more graphically in the water levels of our tributary reservoirs. By early summer, these reservoirs probably will range from 20 to 40 feet below the desired levels. But lake levels are only the visible part of the problem. The less visible consequences are even worse.

Water normally stored during the spring filling is needed to help maintain Tennessee River streamflows during the summer months. We could face real problems this summer in keeping water levels above municipal and industrial water intake structures and in maintaining sufficient springflow to dilute wastes from various sources.

To help address this situation through our reservoir operations, we are increasing our emphasis on providing adequate water supply and to meet drinking water needs.

Paralleling this initiative are major renewed efforts to permit releases from dams to meet minimum flows required for water quality at critical points downstream. We also face the challenge of minimizing, as best we can, the drought's impacts on our continuing responsibilities for commercial navigation and the generation of hydroelectric power.

We have begun a monitoring program to provide information to cities and industries about dissolved oxygen levels, water temperature, and other factors that effect water treatment. I have asked the Governors of the Tennessee Valley States to appoint representatives to a drought task force. That group had its first meeting last week to discuss needed cooperative responses.

These drought-related activities represent only one aspect of our concern for the water resources of the Tennessee Valley. We are also taking our most comprehensive look in 50 years at the way TVA manages its entire reservoir system. Some 800 people have attended 11 public meetings held across the region as part of this ongoing study of reservoir priorities.

I bring these matters to your attention in order to keep a clear and open line of communication between members of the subcommittee and TVA.

Mr. Chairman, at this point, I will submit for the record a summary of the President's request for TVA in fiscal year 1989. That amount, about $76 million, is slightly greater than the administration requested last year and is about $25 million less than Congress approved.

As you know, TVA's power program is entirely self-financed and does not receive appropriated or taxpayer funds. But at this time, I would like to provide the subcommittee with a brief of the power program and its outlook for the remainder of this fiscal year.

NUCLEAR POWERPLANT UPDATE

Some of the best news that we have had in a long time came last Friday when we restarted the first of our nuclear reactors. Unit 2 of our Sequoyah Nuclear Plant near Chattanooga resumed operation when it went critical at 12:20 p.m. on Friday.

By 9 p.m., it was operating at the 15-percent power level, enabling electricity generated at Sequoyah to contribute to our power supply system and to a more competitive TVA. The reactor reached the 30-percent power level on Saturday and today, at this time, is operating at 40-percent power.

The restart of Unit 2 at Sequoyah is a tribute to our employees' dedication to quality, safety, and teamwork. Working together, TVA employees also are ready to meet the challenges of the future in nuclear generation and to achieve the high standards of safety and productivity in operating unit 2 and returning other units to reliable service.

I must emphasize that TVA has followed a philosophy of achieving fundamental improvements in all aspects of the nuclear program. Whether the problems have been in design, construction, maintenance, management, or operations, we have worked to correct the root causes.

These improvements should enable TVA nuclear units to operate safely and efficiently for many years and help TVA regain its traditional position as a leader in nuclear power generation. This commitment to being the best is one that I fully endorse and support.

NONNUCLEAR POWER ACTIVITIES

The nonnuclear elements of TVA's power system once again have performed extremely well. Through the dedicated efforts of TVA's power system employees, our 11 coal-fired generating plants in fiscal year 1987 again produced near record levels of generation, a total of 78.6 billion kilowatt-hours. This represented 71 percent of TVA's total power requirements.

The drought continued to hold down hydroelectric generation last year. Fortunately, we were able to purchase large blocks of power from neighboring electric systems at attractive prices.

On balance, this good operating record meant that TVA was able to hold electric rates for this year to a modest increase of less than 2 percent once we had settled our contract dispute with the U.S. Department of Energy.

Of special interest this year is the atmospheric fluidized bed combustion demonstration facility, which is nearing completion ahead of schedule at Paducah, Ky. Dedication ceremonies are scheduled in early October for this 160-megawatt demonstration facility, the nation's first application of the AFBC technology to electric generation in a plant of this size.

The process promises a cleaner and more efficient way to use the nation's plentiful high-sulfur coal supply to generate electric power. This project is being financed and managed by a consortium of interested parties from both the public and private sectors.

It is a striking and successful example of collaboration between TVA, the federal and state governments, investor-owned electric systems, equipment manufacturers, and coal producers.

I hope that this presentation has proved useful in outlining TVA's corporate objectives as well as ways we are meeting the challenge we face today, and our continuing regional and national responsibilities.

My colleagues on the TVA Board and I will be pleased to respond to any questions you may have at this time.

Thank you.

[The statement follows:]

STATEMENT OF MARVIN RUNYON

Mr. Chairman, members of the Subcommittee. I appreciate the opportunity to appear before you today to present the Administration's fiscal year 1989 budget request for TVA.

Before discussing the specific elements of the budget, it may be helpful to the Subcommittee for me to review several matters of interest.

Since becoming Chairman, I've been involved in an extensive examination and review of all aspects of TVA's operations.

I've talked with more than 10,000 TVA employees, and met with business, community, and elected officials throughout the region.

I've also studied TVA's past performance and future plans.

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To reach these objectives, we'll have to reduce personnel; cut overhead costs; limit the scope of some of our activities as a power system; and organize ourselves in a more businesslike manner.

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Put quite simply, we're committed to demonstrating that a government-owned corporation can compete in terms of quality and productivity with any company in America.

Let me now turn to one resource issue of particular concern to members of this Subcommittee and to TVA.

That issue is the impact of the four-year drought that is holding our region in its grip.

Over the past four years, rainfall in the Tennessee Valley has been about 51 inches below what is normal for that period.

In other words, we have a rainfall deficit that's the equivalent of an entire year without rain.

The results can be seen most graphically in the water levels of our tributary reservoirs. By early summer, these reservoirs probably will range from 20 to 40 feet below desired levels.

But lake levels are only the most visible part of the problem. The less visible consequences are even worse.

Water normally stored during the spring filling is needed to help maintain Tennessee River streamflows during the summer months.

We could face real problems this summer in keeping water levels above municipal and industrial water intake structures, and in maintaining sufficient streamflow to dilute wastes from various sources.

To help address this situation through our reservoir operations, we are increasing our emphasis on providing adequate water supply to meet drinking water needs.

Paralleling this initiative are major renewed efforts to permit releases from dams to meet minimum flows required for water quality at critical points downstream.

And we also face the challenges of minimizing, as best we can, the drought's impacts on our continuing responsibilities for commercial navigation and the generation of hydroelectric power.

We've begun a monitoring program to provide information to cities and industries about dissolved oxygen levels, water temperature, and other factors that affect water treatment.

And I asked the Governors of the Tennessee Valley states to appoint representatives to a drought task force. That group had its first meeting last week to discuss needed cooperative responses.

These drought-related activities represent only one aspect of our concern for the water resources of the Tennessee Valley.

We're also taking our most comprehensive look in 50 years at the way TVA manages its entire reservoir system.

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Some 800 people have attended 11 public meetings held across the region as part of this ongoing study of reservoir priorities.

I bring these matters to your attention in order to keep a clear and open line of communication between members of the Subcommittee and TVA.

With these observations in mind, I will summarize the President's request of about 76 million dollars for TVA in fiscal year 1989.

This amount is slightly greater than the Administration requested last year, and is about 25 million dollars less than Congress approved.

In capital expenditures, the Administration requests 6.253 million dollars for TVA's dam safety program and various additions and improvements to TVA's multipurpose system of dams and reservoirs.

TVA has developed a comprehensive program to ensure the safety of its dams, following the Federal guidelines for dam safety. This program is being carried out in an orderly way.

In 1989, this program will include design work for Chickamauga, completing modifications at Beech and Fort Loudoun Dams, and continued construction at Tellico Dam.

To support TVA's various responsibilities and activities in natural resources, the Administration requests 33.770 million dollars.

Reservoir system operations is closely tied to navigation, flood control, and power production--the primary purposes for which the reservoirs were constructed. Control of aquatic weeds is a problem of increasing importance. A total of 21.610 million dollars is requested for these activities.

In water resources, 2.250 million dollars is requested by the Administration to continue TVA's reservoir releases improvement work, reservoir water management, and flood plain management activities.

Reservoir release activities seek to increase the level of dissolved oxygen in the streams below our dams during summer months. These funds also permit TVA to maintain valuable data bases used in monitoring water quality trends and fighting pollution problems.

The decreases in the FY 1989 budget reflect the Administration's position that the primary responsibility for addressing water quality issues resides with state and local governments.

550,000 dollars is requested for land and forest resources. This will permit TVA to continue managing critical wetlands through maintaining dewatering areas that adjoin the main reservoir system.

Funding of 3.160 million dollars for resource management and development support will continue TVA's work of producing maps of the Valley, as part of the U.S. Geological Survey's national mapping program. In addition, these funds will support TVA's compliance with Federal and State environmental regulations and TVA's participation in the National Acid Precipitation Assessment Program.

The request of 6.2 million dollars for Land Between the Lakes (LBL) will continue programs at near the 1988 level. In addition, TVA increasingly is applying user fees for various activities. This strategy is aimed at (1) allocating more of the operating costs of this facility to its users and (2) creating more self-sufficient activities in the future.

The Administration is requesting 250,000 dollars in economic resource programs. Funds will be used to study state and local laws and policies to identify economic incentives that might be initiated to attract industrial and commercial businesses to Valley states.

The 1989 budget assumes the termination, on a government-wide basis, of local and regional economic development programs. This reflects the Administration's belief that the best approach to this type of activity is through state and local incentives that will create the climate for lasting growth.

In the national fertilizer development program, TVA is working hard to build cooperative funding relationships with the private sector to support research, demonstration, and commercialization activities.

Various user fees also have been established for private firms that benefit from TVA's innovations in fertilizer development. In fiscal year 1989, we estimate that some four million dollars will be generated from non-governmental sources.

Appropriated funds totaling 28.681 million dollars are requested by the Administration to support TVA's basic program at the National Fertilizer Development Center, the Nation's laboratory for fertilizer R&D. This includes 3.6 million dollars of capital expenditures, principally for research support facilities.

The request of 3.031 million dollars for the hardwood research and testing program would permit continuation of this renewable energy program at the current level.

TVA has also restructured its agricultural resources development activities into the Agricultural Institute. Here the focus is on practical solutions to the crisis in Valley agriculture.

Efforts include developing new cash crops, new markets, and new cooperative marketing mechanisms to help Valley family farms survive in today's competitive economy. The program is conducted with Federal, state, and local organizations, with each contributing significant resources and expertise to make the program more self-sufficient and improve program results.

As you know, TVA's power program is entirely self-financed and does not receive appropriated or taxpayer funds. But at this time I would like to provide the Subcommittee with a brief overview of the power program and its outlook for the remainder of this fiscal year.

Some of the best news we've had in a long time came last Friday when we restarted the first of our nuclear reactors. Unit 2 of our Sequoyah Nuclear Plant near Chattanooga resumed operation when it went critical at 12:20 p.m. on Friday.

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The restart of Unit 2 at Sequoyah is a tribute to our employees' dedication to quality, safety, and teamwork. Working together, TVA employees also are ready to meet the challenges of the future in nuclear generation and to achieve the highest standards of safety and productivity in operating Unit 2 and returning other units to reliable service.

I must emphasize that TVA has followed a philosophy ofachieving fundamental improvements in all aspects of the nuclear program. Whether the problems have been in design, construction, maintenance, management, or operations we have worked to correct the root causes.

These improvements should enable TVA's nuclear units to operate safely and efficiently for many years and help TVA regain its traditional position as a leader in nuclear power generation.

This commitment to being "the best" is one that I fully endorse and support.

The non-nuclear elements of TVA's power system once again have performed extremely well. Through the dedicated efforts of TVA's power system employees, our 11 coal-fired generating plants in fiscal year 1987 again produced near record levels of generation--a total of 78.6 billion kilowatthours. This represented 71 percent of TVA's total power requirements.

The drought continued to hold down hydroelectric generation last year. Fortunately, we were able to purchase large blocks of power from neighboring electric systems at attractive prices.

On balance, this good operating record meant that TVA was able to hold electric rates for this year to a modest increase of less than 2 percent, once we had settled our contract dispute with the U.S. Department of Energy.

Of special interest this year is the Atmospheric Fluidized Bed Combustion demonstration facility, which is nearing completion--ahead of schedule--at Paducah, Kentucky.

Dedication ceremonies are scheduled October 7 for this 160-megawatt demonstration facility the Nation's first application of the AFBC technology to electricity generation in a plant of this size.

The process promises a cleaner and more efficient way to use the Nation's plentiful high-sulfur coal supply to generate electric power. This project is being financed and managed by a consortium of interested parties from both the public and private sectors.

It is a striking and successful example of collaboration ~~among~~ between TVA, the Federal and state governments, investor-owned electric systems, equipment manufacturers, and coal producers.

I hope this presentation has proved useful in outlining TVA's corporate objectives as well as ways we're meeting the challenges we face today and our continuing regional and national responsibilities.

My colleagues on the TVA Board and I will be pleased to respond to any questions you may have.

Senator SASSER. Thank you very much, Mr. Chairman.

Do either one of the Directors have anything to add to the Chairman's statement?

Mr. Dean. Not at this time, Senator.

Mr. Waters. No; thank you, Mr. Chairman.

Senator SASSER. Thank you, Mr. Chairman, for that statement. I just want to say that there are two or three things in your statement that I would like to comment one

One, I was impressed with the statement you made that the TVA is committed to demonstrating that a government-owned corporation can compete in terms of quality and productivity with any company in the United States. I think that is a very commendable and worthwhile goal. I am going to watch with great interest to see if that goal can be achieved.

ECONOMIC DEVELOPMENT ACTIVITIES

No. 2, the statement that the administration assumes the termination on a governmentwide basis of the regional economic development programs, and the conclusion that this reflects the administration's belief that the best approach to this type of activity, or economic development activity, is through State and local incentives.

I would say, Mr. Chairman, that in my view the administration is 180 degrees off course in that assertion because, as you know, the Tennessee Valley Authority was created to be a regional economic development authority, to fill in the gaps that the state and the local communities were not able to fill in the 1930's, the 1940's, the 1950's, and we find ourselves still, in the Tennessee Valley area, with a per capita income lagging significantly behind the national average.

It is my view that there still needs to be a significant federal participation in the economic development of the Tennessee Valley area and the Tennessee Valley Authority should play a leading role in that economic development, utilizing federal funds to do so.

I want to commend you again, Mr. Chairman, on your assertion that there will be no rate increases in the Tennessee Valley area for the next 3 years. That is music to my ears, I will tell you very frankly, and I am delighted to see that you are taking that position.

With regard to economic development, I think there could be no better catalyst for economic development in the Tennessee Valley area than to have stable and competitive electrical rates, and maintaining those rates at their present level for 3 years, I think, will have a very salutary impact on development all through the Tennessee Valley area.

This general plan to keep rates level for 3 years, could you provide the committee with some details about how you intend to make this plan work?

EFFORTS TO FREEZE POWER RATES

Mr. RUNYON. There are several aspects to keeping the rates level, Mr. Chairman, it does not come easy.

We have made an estimate of what our expenses will be next year. The results of that preliminary analysis indicate that rates would have to go up 6 percent next year to provide the additional $300 million in revenues needed to offset rising costs.

As you know, in setting rates at TVA we have to recover from the ratepayers the cost of producing power for that year. If we left everything as it was and took the normal economic increases that will occur, our rates would go up 6 percent. In order to hold the rates constant for fiscal year 1989, we have to reduce our costs, our operating and maintenance costs, by $300 million.

We are looking at several ways to do that. For example, we have inventories on hand. We have $300 million in coal inventories at our various fossil plants. We are looking at ways to reduce that inventory. If our source of supply is an assured source, we should be able to cut that inventory down. The inventory currently varies from a 40- to 60-day supply.

Senator SASSER. This sounds like "just in time" material supply.

Mr. RUNYON. I have asked them to cut 59 days out of the 60 days, and no one will listen to that. They don't think that that is reasonable, and I have to agree with them. But maybe 10 percent or 20 percent, or somewhere in between that, might be reasonable. If you were to cut 15 percent off an inventory representing a $300 million investment, that is a lot of money we would save on carrying costs.

In the organization arena, we have many levels of management in our agency. We are looking at how we can combine some of those and eliminate some duplication that we might have. We are looking at the way we are organized—who does what, and where it is done—to see if there are ways that we can get back to the proper operating area and do it one time instead of more than one.

We are looking at ways of setting up the organization to establish responsibility or cost centers where they have a budget within which they have to operate. They will have to look at the programs that they now have and determine if those programs are still in the best interest of the ratepayers. It is the ratepayers who are going to have to pay the increase, and we have to consider them at all times.

Those are several of the ways that we are looking. I might add that all of our employees are turning in suggestions. I have received I don't know how many hundreds of suggestions. One day last week, I received over 200 suggestions from employees. These are suggestions to reduce our pay 5 percent, reduce our pay 15 percent; this operation should be stopped, or that operation should be stopped.

Many of our employees are taking a very hard look at belt tightening. I have had employees come to me and say, "You know, it is really time for us to get into a system of real strong accountability. Even if it costs me my job, I would like to see it done."

We have very dedicated employees at TVA. They are looking forward to the future because they know that the economic development that is needed to provide jobs in the valley will not be there if our power rates go up.

We have received letters from the distributors we supply in various cities around the valley saying, "As long as you don't raise rates, we will not raise rates. If we don't raise rates, we can get business to move in here and bring jobs in."

We have a problem, an immediate problem, in that there will be some jobs at TVA which will be eliminated. It is unfortunate that we have to do that, but that is the case. But overall, I think you will see those people be able to get jobs at the new industries coming in as a result of our taking the action to maintain the rates.

TIMING OF ORGANIZATION AND PERSONNEL ACTIONS

Senator SASSER. Mr. Chairman, when do you anticipate that you will begin making layoffs?

Mr. RUNYON. It is our intention to decide on the major organization, the upper part of the organization, at our next Board meeting. Then we can get people in place who will go through the rest of the organization making the remaining changes that need to be made and recommend which programs need to be continued.

We have a Board meeting on July 20 at which time we will announce our rate structure for the following year. This is the preliminary rate review. At that time we will say what our rates are projected to be for the next year. There is a period for study, and then we have another meeting of the Board in August where we set the final rate.

By the end of June, we really need to know what our cost base will be in order to be prepared for that July Board meeting where we announce our projected rates. To answer your question, by the end of June we should know pretty well where we are.

Mr. Chairman, this is a very stressful time for employees in TVA, and I know that. I know that they would like for us to say: "We are going to curtail this program by so many people, and we are going to curtail this program by so many people." But we don't think that that is the way to do it. We think it is better to wait until we know what the programs will be and make those announcements simultaneously as opposed to just coming up every day with a new announcement. I think that creates more havoc than to do it all at one time.

Senator SASSER. I don't disagree with you, Mr. Chairman. I think that is a good way to approach it.

I read with interest today that the TVA Engineering Association has written to you, Mr. Runyon, expressing concern about the treatment of contract employees in the coming layoffs. I have received similar letters from TVA employees myself.

According to the Engineering Association, TVA's total contract value is currently $669 million. I don't vouch for the accuracy of those figures; those are their assertions. I have no reason to doubt them, I can't also guarantee the validity of them. This apparently represents labor hours involved of about 12.1 million labor hours. The pay for the contract workers, I am told, is in some cases two or three times that of regular TVA employees.

I would say, to the extent possible during the upcoming reorganization, the Board should attempt to phase out these contractors rather than phase TVA employees, if at all possible. In other words, phase them out and, perhaps, replace some of them with TVA employees.

Do you think that that is feasible? Can you give the committee an idea of how TVA intends to treat the contractors as it restructures its operations?

Mr. RUNYON. Mr. Chairman, I am sure that you will find, as we lay off employees, we will be laying off contract employees. It would be our hope that we could lay off no TVA employees and lay off all contract employees, but that just isn't possible.

We have some contract employees performing work that we know is going to go away in a very short period of time. We have some work being performed by contract employees because we don't have TVA employees capable of doing the job.

I have received two letters from the Engineering Association you mentioned. I received the letter that you are talking about, and I also received a previous letter. Their request to us is straightforward and I thoroughly agree with it. If we have TVA employees who, with minimal training, could move into those contract jobs, they should do the work. It would certainly be our effort to do that.

Senator SASSER. With regard to laying off employees and, perhaps, retraining some for other jobs, what plans have been made, if any, at this point to ease the transition for the laid off employees, by offering severance pay, or a retraining program, or any other benefit to try to ease the trauma of laying these people off?

Mr. RUNYON. We are in the process of developing those plans.

We have had companies come to us saying, "We would like to be able to interview your employees who are going to be available for work elsewhere." We propose to have an out-placement program so that these employees can talk to people about what might be available outside.

Where we have companies that are interested in hiring our employees we will set up areas for those companies to come and have interviewers to interview our employees who are available for out-placement.

We are looking carefully as we can at ways to make this happen.

ECONOMIC IMPACT OF PERSONNEL LAYOFFS

Senator SASSER. Have you had an opportunity to assess the economic impact of the layoffs in areas of high TVA employee concentration like Knoxville, or like Chattanooga?

Mr. RUNYON. I think the areas of greatest economic impact will be the two cities that you mentioned. We have not made a study to determine what that economic impact would be on those areas.

I am sure that there will be some impact, but I am also sure that some of that impact will be negated by the availability of other jobs in those areas.

POTENTIAL IMPACTS ON ENVIRONMENTAL AND ENERGY PROGRAMS

Senator SASSER. Mr. Chairman, we receive cries of alarm from some constituent groups in the Tennessee Valley area who are concerned that these upcoming cutbacks are going to result, as they put it, "In gutting the TVA environmental and energy conservation programs."

Can you lay their fears to rest, and what do you see about the future of energy conservation in the Tennessee Valley area?

Mr. RUNYON. It would be difficult to allay any one particular group's fears at this point in time. We are studying all of the programs that TVA is involved in. Until we come to a final conclusion on which programs will be affected, it would be very difficult to say that one is not and one is.

NUCLEAR POWER PROGRAM

Senator SASSER. Let's move on the nuclear program, and I am not going to press you here today on many of these questions because I understand that this is a very stressful time for the Tennessee Valley Authority. I understand that you need some running room here to plan for the orderly departure of some employees, that you need to maintain employee morale along the way, and that you need to put in place programs to cushion the shock as much possible, and programs to move these employees that might be laid off into other jobs.

At the appropriate time, I am sure the committee will want a full explanation, will want to look into the plans in great detail, but I am not going to push you unduly on these issues today because you do have a tough time ahead and these employees have some tough times ahead.

Let's talk about the nuclear program. I stated earlier that we were aware that the Sequoyah unit 2 was back on line last Friday, and that is the best news I have heard coming out of the Tennessee Valley Authority, I will say to you, in years.

What is the schedule for restarting the other licensed nuclear plants at this point?

Mr. RUNYON. At this point in time, Sequoyah unit 1 has a schedule for startup in September. Realistically, it means that we have an expectation that the unit will be on-stream by the end of the year.

The next unit to come on stream is Browns Ferry unit No. 2. At the present time the plan projects it being on line by the end of this year or the first of next year. Beyond that, we have plans for units to come on stream about every 18 months; I am talking about the remaining units at Browns Ferry and at Watts Bar.

What we are doing right now in connection with our overall plan is to determine what that schedule really should be. Should that schedule be slowed down, or should it be speeded up? Where do we stand with regard to the need for the generation of that power?

It might be that we would slow some of these units down and develop a construction force sized to go from one plant to another as we start up successive plants.

The idea of starting up three nuclear plants at one time is very heroic at the least. Starting off one nuclear plant is a very, very difficult task, and yet we have the task of starting Sequoyah unit 2 going on now, and also starting Sequoyah unit 1 and Browns Ferry unit 2, all within 6 months.

I might add that Sequoyoah unit 2 will have to go off-line in about 6 months for a fuel changeover, but that will be a planned outage, after which it will be brought back up again. But it is yet another complicating factor in the workload before us.

We are looking at ways to stabilize that workload, to cut down on the amount of overtime that we are working. We are working tremendous amounts of overtime, Mr. Chairman, in our nuclear program. We are looking to see if that is really necessary. Is there is a way to reduce cost in that program by cutting out overtime, and determining what is really necessary?

Long term, we have underway a program to determine the long-term need for power generation. As you know, behind Sequoyah and Browns Ferry we have Watts Bar and Bellefonte. Right now those schedules read something like 1991 for Watts Bar and 1994 for Bellefonte. We are making another analysis of those schedules. It will requires about 11 months using outside people to help us by coming in to make PRA's—probabilistic risk assessments.

Senator SASSER. I will bet that you can't say it again.

Mr. RUNYON. I can't say it again, Mr. Chairman. I hope it got in the record. [Laughter.]

I started to say PRA and let it go, but I thought, what the heck.

When that analysis is completed we will know more about where we are going and what our needs are, because as we are going now—you know, we have $8 billion sitting there in those plants waiting to go into our rate structure, $8 billion. When they go on line, they take with them that price tag. If a decision is made not to go on line, they still have the price tag. The fate of those plants is a very important decision that we will have to make one of these days and we need good, sound, factual information to help make that decision.

Senator SASSER. That is going to be a tough decision. It has been almost 10 years ago, in Knoxville, I held some hearings and confronted a previous chairman of the Tennessee Valley Authority, who I now see is giving you advice through the newspapers or long distance.

I asked him at that time about the real need for all of this nuclear capacity and expressed the opinion that TVA was overbuilding in the area of nuclear capacity, and that TVA should cut back on the number of nuclear reactors if was building.

He told me at that time, he said: "Senator, if we do that, the lights are going to go out of the Tennessee Valley area and it is going to be your fault." He went ahead with these very large plans for nuclear reactors, and now we are stuck with them to some extent.

Did you give us your load projections with regard to Bellefonte? Do you expect Bellefonte to come on line?

Mr. RUNYON. Mr. Chairman, as I said, until we have our study completed, and this is not only a study of——

Senator SASSER. You can't tell us at this juncture?

Mr. RUNYON. I would have to give it to you for the record. I cannot tell you at this point.

Mr. DEAN. The general plan projects a 1994 to 1995 timeframe for the first unit at Bellefonte to come on line, but that all depends on which of our three load forecasts comes to pass. The midrange is the one projecting the dates I am talking about. Demand creeps up toward the after years of our load forecast. In the past couple of years we have had good growth, and, if that continues, the unit might be needed sooner. All of this is a part of the study that the Chairman referred to earlier.

HARRASSMENT OF WHISTLE BLOWERS

Senator SASSER. Let me ask you a question about whistle blowers.

I know, Mr. Chairman, that you have not been at Tennessee Valley Authority long enough to get into all of the details about how the nuclear construction sites are managed. But my office gets a lot of letters expressing very serious safety concerns and, frankly, I share these concerns. I suspect that you and the other Directors share them also.

Some of the complaints I hear go like this, and let me paraphrase them. They say that anyone who brings up a serious safety concern at a TVA nuclear plant is subject to harassment and intimidation in the form of job pressure and job advancement. Frankly, that is what I have been hearing.

I am aware of the fact that some whistle blowers have their own personal agenda, and they have ideas of their own. But some of the concerns raised by the TVA whistle blowers have proven to be well-founded. Many times where there is a lot of smoke, you do find a spark or two.

What are your own views on the question of the intimidation and harassment charges that we hear from whistle blowers, and what is your policy and what will your policy be with regard to whistle blowers in the Tennessee Valley Authorty staff?

Mr. RUNYON. Mr. Chairman, I have looked at several statistics about employee complaints. I think that TVA has done a great job by installing an Inspector General who can investigate those kinds of claims from an impartial standpoint; not responsible, really, to the Board, but reporting to the Board about what those claims are.

An Employee Concerns Program was set up at TVA and the number of concerns employees have today is dramatically reduced from what they were 3 years ago when the nuclear plants were shut down.

I think you will still get some complaint letters. I have had such letters and they are immediately given to the Inspector General to make investigations. We are finding that the number of those letters has diminished to a few. The findings are generally favorable from the standpoint of how we handle complaints.

Yes; we do have some problems some times, and when we have problems, we handle those problems because we have good information from the Inspector General.

Senator SASSER. Can the word go out here and now, Mr. Chairman, that under the administration of Marvin Runyon at the Tennessee Valley Authority, those who raise legitimate safety concerns are not going to be subject to harassment or intimidation, or that their advancement through the TVA promotion hierarchy is not going to be hurt in any way?

Mr. RUNYON. I agree that is the word we need to get out here now.

We do not want harassment. We do not want harassment for whistle blowers. We do not want harassment for females. We do not want harassment for minorities. We want to operate our business the way people want to be treated. People are our most important resource, and we recognize that.

INSPECTOR GENERAL ACTIVITIES

Senator SASSER. Let me just say that I very much appreciate and understand your remarks about the Inspector General.

A short time ago, as I went around the state of Tennessee, and went into these various county meetings, invariably after the meetings there would be a tiny knot of individuals standing around who wanted to talk to me privately and confidentially about some real or imagined outrage that had occurred on the job, principally construction jobs where they felt unduly influenced, et cetera, et cetera.

Since the Inspector General has come on line at TVA that has fallen almost off to nothing. I very much applaud the work that is being carried on in the Inspector General's Office. Some of your former Board members were not too enthusiastic initially about the idea of an Inspector General, but I think they would agree now. I think they have finally seen the light on that.

I think we would all agree that the Inspector General's Office has gone a long way to taking some of these allegations, subjecting them to professional investigation, and professional evaluation, and laying these controversies to rest, rather than letting them fester and fester, and being embroidered on as time went on, and blow up into great problem in many occasions, when they started out with just a small problem.

Mr. RUNYON. Mr. Chairman, the Inspector General was at TVA when I arrived. I would like to point out that the two Board members present at the table with me are the ones who brought Mr. Zigrossi to TVA. I have to commend them for their wisdom in doing that.

Senator SASSER. That was a very commendable action on their part. I might say that at the outset, they had some doubts about it. I think those doubts have been resolved. I think they have resolved them in their own mind, and I think that anybody who watches the Inspector General's Office in operation objectively is going to say that it has been a good thing for the Tennessee Valley Authority.

Mr. WATERS. Mr. Chairman, I well recall that you gave us some encouragement to install an Inspector General. We did heed that encouragement and it was, I think, a very proper thing to do.

The Office was established in October 1985. Norman Zigrossi, as you know, is a very, very professional person. I can assure you that he follows the facts wherever they lead him and without any fear or favor. He is an professional investigator and he has done an outstanding job for TVA.

I don't know how we could have handled those 4,000 to 5,000 complaints and employee concerns that were registered at Watts Bar, especially those that related to intimidation and harassment, without the Inspector General's Office.

The Inspector General and his staff have served TVA well. They have served the ratepayer well. They do a good job. You encouraged us to establish that Office because you saw a real need. It has worked out, I think, very well.

Senator SASSER. Thank you very much. I think that you did a good job in selecting the man for the post. I have been impressed with him in my contacts with him and in his testimony here not too long ago before the Small Business Committee.

WATTS BAR NUCLEAR POWERPLANT

Let me ask you a specific question about Watts Bar. It is my understanding that the NRC Resident Inspector has continued to be concerned about the significant programmatic and implementation deficiencies in the Watts Bar quality assurance program. I am told that these long-standing concerns from before 1985–86 and that there is fear that they still persist.

What is your feeling about the quality assurance at Watts Bar at this stage, Mr. Runyon?

Mr. RUNYON. Mr. Chairman, my emphasis has been placed primarily on Sequoyah and Browns Ferry because Sequoyah, as you know, has just become critical, and I felt that I should pay more attention to what was going on at Sequoyah than at Watts Bar, to be quite frank with you.

I have been to Watts Bar on one occasion. I am aware that a $50 million study has been completed recently to determine the integrity of welds in one of the units at Watts Bar. The report turned out very satisfactory.

I would have to say to you that before we would get very serious about putting that plant on stream, I would need to have much more investigation done, both for me and by me to answer that comment.

Senator SASSER. Let me just ask you this question now. What is your assessment of Steve White's performance to date? I have asked that question quite often and I would like to get your answer to it.

Mr. RUNYON. I think Steve White's performance has been outstanding. I think the fact that we have been able to bring Sequoyah back on stream is indicative of his ability. I think that he put a workforce in place, put in workforce practices, put in training of the workforce, put in discipline in the workforce, so that we could start that plant up and feel very good about it.

I am very positive about Steve White's performance at the present time.

Senator SASSER. What about the NRC, do you feel that the NRC is dealing fairly with TVA in its oversight of the nuclear program or is TVA being treated unfairly?

Mr. RUNYON. I think that the NRC has a job to do. They saw an operation at TVA that was not in very good shape 3 years ago. They set about to change that. Where they find things wrong, they tell us about it and we correct them. This is as it should be.

I really can't have any quarrel with NRC wanting things to be right before we start up any nuclear plant. I want things to be right. I want to make sure that our operations are safe before they start. I think that the oversight NRC has been giving us has helped us to reach that point.

Senator SASSER. Were you aware, Mr. Chairman, of any penalties that the NRC plans to assess against for safety violations at this juncture?

Mr. RUNYON. The NRC has not notified me of any penalties they have been assessed against us; no, sir.

Senator SASSER. You know of no plans for penalties to be assessed in the immediate future?

Mr. RUNYON. I have read in the newspapers about some possible penalties that could be assessed.

Senator SASSER. But no notice from the NRC that they may be on the way?

Mr. RUNYON. No, sir; I have no notice from NRC.

Senator SASSER. Let's talk about the budget request. What level of funding did TVA request from the Office of Management and Budget this year?

Mr. RUNYON. We requested $138 million in our initial request.

Senator SASSER. What was the basis of this request?

Mr. RUNYON. The basis was the programs that we felt that we needed to get back to an operating level where we were in the mid-eighties. There are many programs which we have had to cut which we felt needed to be reinstalled.

NATURAL RESOURCE MANAGEMENT ACTIVITIES

Senator SASSER. One of the things that concerns me particularly about these budget cuts that the administration is proposing is the adverse impact that this may have on TVA's resources management programs. I am particularly concerned about those that are designed to assure water quality at places like Kentucky Lake and also Boone Lake.

We are plowing really new ground in the Tennessee Valley area because that river system there is the most heavily dammed system in the world. As we see these reservoirs there starting to age, we are really exploring new frontiers with regard to what happens environmentally to a river that is that heavily dammed and what happens to these reservoirs as they age.

I am concerned about the budget cuts on these water quality programs in places like Kentucky Lake and Boone Lake. How do you think the President's budget proposals would affect these water quality programs?

Mr. RUNYON. It would reduce the funds available for those water quality programs.

I might add that the situation with respect to Kentucky Lake and the other TVA reservoirs is being very seriously impacted by the drought that we are in right now. As this drought continues on, the situation will only become worse and we will have to add more funds to adequately handle the water quality programs.

For example, because of the drought this year we are having to find some $600,000 for studies being made right now to determine how to handle this drought.

One of the things I have learned since being in this job, Mr. Chairman, is that people who have a lot of water normally handle a drought situation worse than those who don't. People who don't have water are able to do without it very well. But those of us who have been so fortunate and so blessed as to live in the Tennessee Valley and have all of this abundance of water; when it stops being there, we have a difficult time dealing with it.

We have life styles and habits that are created over time because we have this superabundance of good, clean, fresh water. When we don't have it, it is very difficult for us to change the way we live each day and to choose the habits that we develop with relation to water.

Senator SASSER. I am concerned, as I indicated earlier, about the water quality problems and, of course, they have been exacerbated considerably by the unprecedented drought conditions that we have had in the Tennessee Valley area. As you indicated in your opening statement, the drought has reached such proportions that it is just like having no rainfall for 1 out of every 4 years.

Mr. Chairman, I understand that last year TVA suffered a couple of adverse legal judgments that made a substantial dent in your budget, as well as some other unanticipated expenses. Could you shed any light on these expenditures and the problems that they have created for you and for the Tennessee Valley Authority?

Mr. RUNYON. You mentioned a couple. One comes to mind rapidly, and this was at the National Fertilizer Center where an employee fell to an untimely death while working on the roof of a building there, and the judgment was received to the tune of $2 million. I am well aware of that one.

I do not know of any additional judgment.

Mr. DEAN. We also had a fire at the fertilizer center that resulted in a rather severe loss.

Senator SASSER. Did that require the expenditure of money?

Mr. DEAN. Yes.

Senator SASSER. How substantial was it?

Mr. DEAN. One million dollars.

Mr. Waters. We were talking about the financial outlook for the current year and asked if it looked like we were going to have any carryover, and the answer was a very definite "No."

Senator SASSER. Gentlemen, we have been joined by my distinguished colleague from Mississippi, Senator Cochran, who is a member of this subcommittee and who has a long-standing and enduring interest in the Tennessee Valley Authority.

I want to defer now to Senator Cochran for any statement he might wish to make or any question that he might wish to ask.

Senator COCHRAN. Thank you very much, Mr. Chairman.

We welcome you all here today, particularly our new Chairman, Mr. Runyon, to the committee. We are glad to have you here. It is a pleasure to work with you in trying to make sure that the Tennessee Valley Authority continues to be responsive to the economic needs and well-being of the people of the region served by it.

In our state of Mississippi, we are very proud of the fact that the first city to ever be served by power from TVA was Tupelo, Miss. We feel a very close relationship with TVA in our state and we appreciate it. We appreciate the work that is done not only in providing power, but also economic progress for our area and new jobs in the region.

In that connection, I wonder whether or not it will be, in your view, Mr. Chairman, the responsibility of TVA to work with local officials and with the public at large to try to help insure continued economic progress and new job creation in the TVA region, particularly along the Tennessee-Tombigbee Waterway that we are very proud to have in area?

Mr. RUNYON. Senator, we are very interested in seeing jobs develop in the Tennessee Valley Authority's area. One of the reasons that we set the objective to maintain our firm power rates constant was so that industry could plan on what their costs would be and we would attract industry to come into this area.

We can also attract industry to stay. We have some industries in our area that are leaving us, and will leave us in the future, if our rates continue to go up. So we think that it is very important that we maintain our rates.

We are very interested in seeing the Tennessee Valley region grow. We are interested in seeing increased jobs in that area. We are taking all the steps that we can to do that.

Senator COCHRAN. I notice that you have announced a plan to consolidate and to reorganize that may and up resulting in a freeze on employment. I don't have the figures here before me, but I recall being advised about this proposal.

What has been the fallout, the impact? Have you had anyone applaud you, or has everyone just found something to criticize?

Mr. RUNYON. As a matter of fact, we have not had criticism. The Chairman mentioned a couple of letters that were received from one organization, but those letters were not criticisms. Those letters were written to ask us to do this in a fair manner.

We have had no complaints from people saying you should not do it. On the contrary, we are hearing compliments from organizations which represent our employees at TVA, and from business people. We are having TVA employees themselves say, "This is good, we want to do this," or "I may lose my job, but we think that you are doing the right thing."

I think people are well aware that if we are not competitive, we won't be in business in 6 to 8 years. If we continue to raise our rates 6 percent a year, then somebody else is going to come in and take our business, and if they take our business, they take all of our jobs, not just a few of our jobs.

Senator COCHRAN. I think the attitude that you are showing in terms of coming in and taking charge, and trying to get a handle on what the cost problems are, what the overhead problems are, is to be applauded and I applaud you for it.

I want you to know that I am going to try to work here as a member of this committee to see that the appropriation of funds is realistic and adequate to help meet the needs of this agency within the framework of deficit control and the realities that we face in dealing with the budget resolution that imposes a cap and limits on what we can appropriate.

But within the framework of our budget process and the realities of the deficit reduction effort, I want to see that TVA is treated fairly and that you get an adequate level of funding so that you can do the job that was contemplated when the Authority was created.

Mr. Chairman, I don't have any other questions, but I appreciate very much your recognizing me and for having the hearing today to give us a chance to express our thoughts and to find a little more of the details of what is going on and what the next year looks like for TVA and its citizens.

Thank you.

Senator SASSER. Thank you, Senator Cochran. I was very delighted to hear your remarks about wanting to work to see that the TVA gets the funds that are necessary to do their nonpower programs out of the appropriated budget.

As I indicated before your arrival, TVA has suffered a 50-percent cut in their appropriated budget over the past several years and the administration is attempting to cut another 25 percent this year as you know. I look forward to working with you to try to restore as much of that cut as possible. Hopefully, we can restore at least all of that.

INDUSTRIAL POWER RATES

Mr. Chairman, one question comes to mind. You indicated that you are going to hold these rates stable and flat for 3 years. That is commendable and something that I think has to be done.

I have heard for some time complaints from business leaders in Tennessee, and I suspect that Senator Cochran has heard some from Mississippi, from business leaders there, in which they are saying that the rates TVA area are becoming noncompetitive as far as industrial power is concerned, and that they are going to move some of their businesses out or they are not going to be attracted into the Tennessee Valley.

If we could hold those rates flat for 3 years, do you have any projections as to where that might put us with regard to industrial rates in surrounding states?

Mr. RUNYON. I have not made a projection like that, but I don't believe there are many companies in the utility business these days that are making the effort to hold their rates constant. In some cases, their rates are going up considerably. I see utilities asking for rate increases of 25 percent when they put new nuclear plants on stream.

Senator SASSER. If we could hold those rates constant for 3 years, as you and your colleagues on the Board are attempting to do, I suspect that that would give us a real advantage from the point of view of attracting industry and retaining industry in the Tennessee Valley area, because I visualize the time when we are going to have a dual advantage in the Tennessee Valley area of cheaper rates and also excess capacity.

We are biting the bullet. One of the spinoffs of what I see as excessive building of nuclear powerplants is that we are going to have some excess capacity at some juncture in the not too distant future in the Tennessee Valley area. There is hardly any place else in the country where that is going to happen, because the other utilities have been pulling back from building additional capacity because it is so expensive.

We are going to have it there, and if we can hold the rates low in conjunction with the ability to supply the power, I think that we could very well be sitting captor's seat 4 or 5 years down the line.

RESTRUCTURING TVA BOARD OF DIRECTORS

Let me ask you this question. There has been a lot of conversation floating around for a number of years about the restructuring the TVA's Board and reorganizing TVA's general operations. Do you perceive any need in the immediate future to restructure the Board, or do you have a desire to restructure the Board, to enlarge it?

There has been one plan advanced to have Board members nominated or recommended by the several Governors of the region served by TVA, et cetera.

What is your view on the way the Board is presently operating and is there a need for restructuring or enlarging it?

Mr. RUNYON. Mr. Chairman, when you come to it with a fresh perspective, such as when I was considering allowing my name to be placed in nomination for this position, I thought about that considerably. My thought process told me that if I go into that position, the immediate situation will include three directors. There won't be an immediate change, because it takes time for laws to take place if one were introduced.

I analyzed how TVA had been operating for the past 55 years and saw that it had worked with three directors for 55 years. I developed a mind set which said, "Well, it worked for 55 years, let's try it and see how it works." We have been doing that now for a little over 3 months. I think that it works very well with the three directors the way it is now.

When I became Chairman 3 months ago, I said I would like to take a year and then make a recommendation based on my experience. Right now my experience is good. As a Board, it works very well.

We do plan to make some changes in the organization. There will be some recommendations made at our next Board meeting and we will decide whether we will accept those recommendations or not.

We intend to put more accountability into the organization, and that can be done without a nine-member board and a chief executive officer who is appointed by that nine-member board. We can have efficiency built into the organization, and we are looking at ways to do that.

I think that we need to give the present Board time to take care of the situation and I think that you would probably approve of that situation 6 to 9 months from now. At least at that time, we will be able to make a commitment as to which way it should be.

Mr. DEAN. I might emphasize, Mr. Chairman, that no change under consideration by the management committee would require any legislation whatsoever.

TVA ADVERTISING CONTRACT

Senator SASSER. Let me bring up one other point here. Gentlemen, I think I would be derelict if I didn't bring it up. It is something that has been reported in the newspapers and it is causing some controversy, and that is the fact that TVA has signed a $750,000 advertising contract with a new magazine.

Mr. Runyon, I know that you were not Chairman when this decision was made, but TVA's total advertising budget, as I understand, is $1.5 million, and half of the budget would be funneled into advertising in one new, unproven magazine. There would be some difficulty, I think, in justifying that here in the Congress, even if it came out of non-appropriated funds, which I assume that it will come from. That would be a matter that I would not want to have to defend before the rest of my colleagues.

I bring that up for your consideration and that of your fellow Directors, and I would be interested in any comments that you might want to make on it at this particular juncture.

Mr. RUNYON. At the time the advertising budget was approved last year, it was for the amount of $3 million. That amount has been reduced to $1.5 million as you have correctly stated. The contract with Tennessee Illustrated was $750,000. It is a signed contract which was executed prior to the time the decisions were made which we are now entering into.

I think, in the light of the austerity program that we are in right now, we would consider the contract in a different perspective. That decision was made in different times. We do have a contract and it would be our intention to honor that contract just as we expect people who have contracts with us to honor contracts with us.

We have other people in this world with whom we deal that we make contracts with, who sometimes go hard on them. We are dealing with some of those right now, because we have the ratepayers' interest in mind.Specifically, I am talking about coal contracts where there have been some agreements made where the cost of coal can be reduced, and we can insist that those reduction costs be transferred through to us.

I think if we expect people to honor contracts with us, we have to honor contracts with them. We made a contract. Regarding the second year of that contract, a decision has to be made in 6 months. At that time we will make a decision as to whether it should be continued or not. The outcome of what happens as a result of that 6 months is what we will have to base our decision on.

Senator SASSER. Do you have any other questions or statements, Senator Cochran?

Senator COCHRAN. I have no other questions, Mr. Chairman. Thank you.

CONCLUDING REMARKS

Senator SASSER. Gentlemen, we very much appreciate your testimony here today.

Mr. Chairman, I will say to you that I think you are on the right track at TVA. I am very impressed with the initial steps that you are taking. You are making some of the hard decisions that, at this particular time in the history of the Tennessee Valley Authority, probably have to be made. I am confident and hopeful that we are going to see some real results in the not too distant future.

I am impressed with your views on trying to run a lean and cost-efficient operation. I think that came through in both your prepared testimony and your spontaneous responses to a number of my questions.

I want to compliment your fellow Directors on the way in which they have cooperated with you and worked in tandem with you. It is not easy to suddenly come under new management and have a new man on the block, so to speak. I perceive that you are working very well together.

It is not to say that you have to be unanimous on everything, and I would hope that there would be some diversity and some debate within the Board. I sometimes think that the best decisions result from a free and vigorous exchange of views.

We do that here every day on the floor of the U.S. Senate and I hope that our decisions are better as a result of that. Sometimes, we find that we get into an area that had completely overlooked and come up with a new and better approach to a problem than the one that we began with.

Overall, I would say that I am encouraged by the initial steps that have been taken. The Tennessee Valley Authority is a proud agency with a proud and glorious history, and I am hopeful that the decade of the 1990's, the early 1990's, can be just as glorious for the Tennessee Valley Authority as the decade that began in 1930, 1940, and 1950 was.

ADDITIONAL PREPARED QUESTIONS SUBMITTED FOR THE RECORD

I have several other questions which I will make part of the record for your response.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR SASSER

NATIONAL SPORTS FISHING CENTER

Question. Last year the committee directed the TVA to request $3 million for a National Sports Fishing Center in Chattanooga. Why wasn't this funding included in the budget?

Answer. TVA did make the $3 million request. However, the Office of Management and Budget disallowed TVA's request for project funding for the National Sports Fishing Center in the 1989 President's budget.

Question. Did the TVA submit the funding request to the Office of Management and Budget when the fiscal year 1989 budget was originally submitted as the committee directed?

Answer. No. The report containing the committee's direction was issued after TVA submitted its original request on September 1, 1987.

Question. When did TVA submit the request to OMB?

Answer. The request was first made orally to OMB staff on September 29, 1987, at a hearing on our 1989 request. The request was later formalized in writing and submitted to OMB on October 26, 1987.

Question. What was OMB's response to the TVA request?

Answer. The request was denied.

Question. Does TVA plan to resubmit the request to OMB for inclusion in the fiscal year 1990 budget?

Answer. The Board has not begun consideration of any programs for which we will propose new or continued funding in the fiscal year 1990 budget.

Question. Given OMB's opposition to the project, to what extent can TVA assist in the development of the center?

Answer. TVA's involvement would be limited to providing technical assistance to the center in refining the development concept and in creating a general development plan.

SUBCOMMITTEE RECESS

Senator **SASSER**. Unless Senator Cochran has something else to add, gentlemen, with that this hearing is concluded and the subcommittee stands in recess.

[Whereupon, at 3:50 p.m. Monday, May 16, the subcommittee was recessed to reconvene at 10 a.m. Tuesday, July 26.]

ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1989

TUESDAY, JULY 26, 1988

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 10:40 a.m. in room SD–192, Dirksen Senate Office Building, Hon. J. Bennett Johnston (chairman) presiding.

Present: Senators Johnston, Hollings, DeConcini, Hatfield, McClure, and Domenici.

DEPARTMENT OF ENERGY

NEW PRODUCTION REACTOR CAPACITY

Senator JOHNSTON. The committee will come to order.

We want to extend a warm welcome to all of you this morning. The purpose of this hearing is to review the Department of Energy's strategy and plans for a new nuclear materials defense production reactor capacity.

This is a matter of paramount importance. This committee has been intimately involved in the process for many years now in helping to assure that special nuclear material needs of the nation for defense requirements are provided in a timely and cost conscious manner.

The Department is proceeding with plans to provide for a new production reactor capacity and has recently received the report of the Energy Research Advisory Board providing assessment of candidate reactor technologies for new production capacity.

So, we want to learn as much as we can this morning about the ERAB views and study, and cover other aspects of this subject as well.

INTRODUCTION OF WITNESSES

First, we want to welcome our witnesses, several distinguished officials who were involved in technology evaluation—Dr. Joseph F. Salgado, Deputy Secretary of Energy; Mr. John H. Schoettler, Chairman of the Energy Research Advisory Board; Dr. William Graham, Science Adviser to the President; Dr. Robert C. Duncan, Assistant Secretary for Research and Technology for the Department of Defense, and Chairman of the Nuclear Weapons Council; and Mr. Troy E. Wade, Acting Assistant Secretary for Defense Programs of the Department of Energy, and DOE member of the Nuclear Weapons Council.

We asked that your oral testimony be as brief as possible. We will put your full statements into the record.

Before I call on Dr. Salgado, I want to ask the distinguished ranking minority member, Senator Hatfield, for any comments he may have.

Senator HATFIELD. Thank you, Mr. Chairman, I have no opening remarks at this time, but I do have some questions that I will either submit for the record or ask during the course of the hearing. Thank you.

Senator JOHNSTON. Senator Hollings, do you have any comments?

SAVANNAH RIVER PRODUCTION CAPABILITY

Senator HOLLINGS. Yes; I thank you very much, Mr. Chairman. The hearing this morning is very timely. The nation clearly needs a new production reactor to meet the important defense needs as you pointed out.

Equally important, the Energy Department's own expert advisers have now given us the facts we need to make the right decisions. That recent report of the Energy Department's Energy Research Advisory Board showed that the heavy water reactor at the Savannah River plant is the best choice.

As our colleagues will recall, this report concluded that building an updated version of the type of reactor already operating at the Savannah River production complex "appears to have the best chance of quickly providing the needed capacity because of the existing facilities, personnel, and experience at Savannah River."

This key passage touches on two vital points. First, we need the capacity quickly. The National Academy of Sciences, this last year, had concluded that the existing reactors need replacement, and in the judgment of the Advisory Board heavy water reactors of the type already operating at Savannah River can be built more quickly than any other type. They can also be built with state-of-the-art safety measures.

I know that some people favor more exotic reactor designs that may even work in the long run, but for now they are unproven and would require substantial research in order to adapt them for defense production needs. The Advisory Board report makes its point simply and directly and I quote:

> The heavy water reactor has the most mature U.S. technology for tritium production at the present time. The other reactor types require varying degrees of research, development, and qualification testing.

In my view, we should not gamble with the nation's security, we should go with the proven approach. Savannah River has the support facilities and experienced personnel needed for large-scale production. In particular, the Savannah River plant has full-scale fuel fabrication and waste handling facilities, including the nearly completed Defense Waste Processing Facility. No other site in the country has this range of support plants. Duplicating them elsewhere would cost billions and take precious time.

These conclusions by the Advisory Board are not surprising. Dr. Keith Glennan chaired a similar panel back in 1982, 6 years ago, and he and his colleagues reached the same conclusion. They said:

The heavy water reactor located at the Savannah River site is the panel's recommended concept, providing the greatest assurance of meeting production goals.

There is another issue. The new Advisory report says that building more than one reactor would provide high production assurances, but it would be at an increased cost. We, in Congress, would like to see three reactors, or maybe four, if we can get them—two at Savannah River, one at Hanford, and then one at Idaho—if we have that much money, but I question whether we have the money.

We will undoubtedly discuss whether to pursue a multiple reactor strategy, but it is incontestable that the first new production reactor should go to Savannah River. It has the proven technology, the experienced personnel, and the needed support facilities.

In short, Savannah River is simply the best site, and I will continue to work for an early decision to put that reactor at the Savannah River plant and to start construction as soon as possible.

Thank you, Mr.Chairman.

Senator JOHNSTON. Thank you, Senator Hollings.

Senator McClure.

Senator McCLURE. Thank you very much, Mr. Chairman.

Senator Hollings might be surprised, but I don't object to the statements by the Chamber of Commerce from Savannah River, and I think that they will be well taken in most respects.

Senator Hollings and Senator Thurmond might also be surprised that I am entirely comfortable with the notion that the first of the production reactors will be built at Savannah River.

That is nothing that I am contesting, but because there seems to be some confusion about what it is that I really wish to accomplish, and to support, and to be able to support Senator Holings and Senator Thurmond, and others, who would want to see a reactor built at Savannah River, I will take just a few minutes to try to outline exactly what I hope this hearing can do and what kind of decision, perhaps, can be supported as a result of it.

ERAB PANEL REPORT

I am really grateful to the chairman for his willingness to schedule this hearing on relatively short notice, and I apologize to him and to you, the witnesses and others, who are interested, that we had an aborted attempt at holding this hearing on July 13, when circumstances beyond our control forced a cancellation.

The ERAB panel has just issued its report on new production reactor technologies to the Department and the decision based on that report, and based on other input, will be made by the end of Juy, which is less than 1 week from today.

By holding this hearing during the decisionmaking process, it is certainly not my intent to delay the process, but rather to make the end result of that process more likely to withstand the test of time. Therefore, I had hoped that all the witnesses that appear here today will listen very carefully to our comments and suggestions, for they are intended to assist you, not deter you, from your goals.

Let me first extend my appreciation to Mr. John Schoettler, the Chairman of the Energy Research Advisory Board, who so willingly agreed to testify on behalf of the ERAB panel.

I understand that Dr. Larry Papay, who actually headed the NPR Technology Assessment Panel, would have also wanted to participate in this hearing had he not already had an unavoidable schedule conflict.

There is no question that Dr. Papay and the members of the ERAB panel did a truly heroic job in assimilating, processing, and evaluating a tremendous amount of information in a very short period of time.

The panel went to great efforts to address all of the evaluation criteria given to them by the Department. At this point, I would like to enter into the record two articles from Nucleonics Week, entitled, "Technology Choices for the New DOD Reactor All Include Uncertainties," and "Weapons Technologies, How Safe Is Safe Enough," which summarize the ERAB report very well.

SAFETY ISSUES

The panel even went a step further than their mandate by elevating safety to a primary role, right alongside of the obviously crucial criteria of tritium production capability. This makes enormous sense to me, because no matter how good a tritium producer we build, we will not be able to run the machine that produces the tritium if we can't do it in a safe and environmentally benign manner.

I just hope that we will all take a hard look into the safety issues before we make a choice of any single technology for the NPR. A prudent delay for the sake of safety will more than pay off later on in terms of avoided costs and risk to the public and, ultimately, in time.

These safety issues are particularly well addressed in a report recently issued by the National Defense Council Foundation, which I would like to enter into the record following my opening remarks. A very succinct summary of this report was printed in the July 25, 1988, issue of the Energy Daily, which I will also include in the record.

NEED FOR DUAL REACTOR SITING

The panel also did an admirable job in addressing another issue that in my estimation is vital to our nation's security; that is, duality of sites and diversity of technologies. As I have said many times before, we simply cannot afford to put all of our eggs in one basket. If we choose to build one full-sized plant at a single site, we are exposing our national security unnecessarily to events that can bring us to our knees in terms of nuclear deterrence capabilities. Whether it is an act of God, a terrorist attack, an unfortunate safety concern, or an unanticipated design flaw, we could find ourselves without any production capability if we select only one site or one technology.

I would like to think we were wiser than to let that happen. After all, we are going to be committing huge amounts of money and time in this effort and if we spend just a little extra to achieve duality and diversity, we would be buying huge amounts in terms of national security. We cannot afford not to do so.

If we were really on our toes, we might even be able to find some way to recoup some of the costs of this endeavor. To that end, the ERAB report suggests that revenues from the sale of steam could significantly offset the costs of building and operating an NPR facility. I will pursue that matter further during questioning, following the oral testimony.

REPORT SHORTCOMINGS AND INCONSISTENCIES

One last comment, Mr. Chairman, concerning the ERAB report. While there were many good points made in the document, I could not help but notice some areas of inconsistencies and some statements which were inadequately substantiated by the facts. I am sure that much of this is a direct result of the shortness of time within which the panel had to finalize its efforts. But, I wouldn't be surprised at all if some of these gaps weren't purposely included to entice those of us with inquisitive minds to go much deeper into many of these issues before making any final decision on NPR capacity. The gaps are so transparent in some instances that I am sure that even the ERAB panel itself would not want to see an NPR technology decision made based solely on this one report.

Which leads me into one final area I wanted to cover and that concerns the process by which the Energy Systems Acquisition Advisory Board, chaired by Mr. Salgado, will assimilate the ERAB report, as well as input from the site evaluation team and other administrative agencies, to come up with a consistent and a coherent and a defensible decision with respect to our future capabilities to produce weapons materials.

I am most anxious, Mr. Chairman, to hear from Secretary Salgado, Dr. Graham, Dr. Duncan, Mr. Wade, and Mr. Ahearne concerning this crucial decisionmaking process.

For the record, I would remind the witnesses, who have so generously agreed to appear here today on such short notice, that the purpose of this hearing is not to delay decisions on the NPR and not to put down the ERAB report or the decisionmaking process, but rather to help enable the process and the outcome to withstand the tests of time in terms of our nation's well being and in terms of the health, safety, and security of our people.

Mr. Chairman, I would ask unanimous consent that the articles to which I made reference be made a part of the record at this point. I also have an article from Energy Daily, and report by the National Defense Council Foundation which I also ask be included in the record.

Senator JOHNSTON. Without objection, so ordered.

[The information follows:]

[From Nucleonics Week, July 14, 1988]

TECHNOLOGY CHOICES FOR NEW DOE REACTOR ALL INCLUDE UNCERTAINTIES

With a decision approaching on a technology for the United States new defense materials production reactor, Nucleonics Week's Danialle Weaver examined the opinions being given DOE. This is the first of her two-part report.

A decision on DOE's new production reactor (NPR), the largest U.S. nuclear power plant order in the foreseeable future, inched closer last week as an expert panel said that a heavy water reactor (HWR) at the Savannah River Plant (SRP) has the best chance of quickly producing tritium for nuclear weapons. However, the panel noted there are technical uncertainties in every design reviewed.

The recommendation by a special Energy Research Advisory Board (ERAB) panel appears to give two teams of HWR proponents—led by Ebasco Services, Inc. and Westinghouse Electric Corp.—an early leg up in the competition for the contract, estimated to be worth $5- to $10-billion over perhaps 10 years. The panel stopped short, however, of a full-fledged endorsement of the HWR technology, noting that other "passively safe" designs would do more to advance reactor technology than an HWR.

After Energy Secretary John Herrington announces by August 1 a preferred technology and site for the NPR, DOE will begin preparing an environmental impact statement (EIS), which could take two years, DOE spokesman Will Callicott said. DOE will issue a request for proposals (RFP) after the EIS is finished.

The NPR eventually would replace DOE's 34-year-old SRP reactors, which are shut down for seismic fixes, routine maintenance, or to comply with state environmental laws (NW, 30 June, 11). The power levels of all three reactors were halved more than a year ago after the National Academy of Sciences (NAS), the first outside review team to examine them, raised questions about the capacities of their emergency cooling systems in the event of a severe accident (NW, 26 March '87, 3).

The Reagan administration postponed the decision to build an NPR because of budget cuts. The administration elected in November could change whatever decision Herrington makes.

Many in DOE have wanted to build a new HWR, rather than gambling on other technologies. DOE statistics show the reactors performed well until safety concerns prompted power cutbacks: as measured by reactor "innage," or operational days per given year (with 365 days equaling 100%), the SRP reactors have dipped below 60% (to 58%) during only three fiscal years. During 18 fiscal years, the reactors averaged between 80% and 84%.

But pressure from Congress and cabinet officials prompted DOE to look at LWRs—as a large plant, a converted commercial reactor, and an "advanced" LWR, at modular high-temperature gas-cooled reactors (MHTGRs), and at liquid metal reactors (LMRs). According to ERAB, the major flaw of the other reactors is that they are unproven tritium producers. The new HWRs would use the SRP fuel and targets, but the other technologies require demonstrations.

For example, Westinghouse, which is proposing all the LWR technologies, would need $91- to $137-million to qualify its targets, depending on how many must be developed and tested and how many tests need to be done, according to Robert Vijuk, Westinghouse manager of space, defense, and nuclear programs. General Atomics' MHTGR target has been developed but would require another $25-million for full-scale target tests and building and operating pilot target fabrication and recovery lines, said Linden Blue, GA's vice chairman of the board.

The major drawback of the HWR is that it is totally new to the safety review process. The SRP reactors have been reviewed by only one outside group; that review resulted in the current power restrictions (NW, 5 Nov., '87, 4).Recent revelations of missing engineering drawings and hand-calculated safety calculations (NW, 9 June, 2) have fueled the debate over the reactors' safety.

Many of the other concepts have been at least par-tially reviewed by NRC, the Advisory Committee on Reactor Safeguards (ACRS), or both. NRC has fully licensed one HTGR and reviewed two large HTGRs through the construction permit stage, ERAB said. The proposed MHTGR is a scaled-down version of the Fort St. Vrain plant that more closely resembles Peach Bottom-1, both of which were licensed by NRC. The ACRS has reviewed DOE's Fast Flux Test Facility, an LMR, although DOE facilities are not subject to NRC review. The large LWR concept is based on Union Electric Co.'s Callaway, which was licensed in 1984.

In addition, the HTGR, LMR, and, to a lesser extent, the small LWR are "passively safe" concepts that rely mainly upon gravity, natural convection and circulation, and a few engineered safety features. Choosing one of those concepts would advance nuclear technology far more than would building another HWR, and should be considered despite somewhat higher initial capital costs, ERAB said.

Safety of Current HWRs Uncertain

The six-loop Savannah River HWRs operate at 2,350 megawatts thermal at full power and are cooled and moderated by heavy water. Each loop contains a pump and a heat exchanger. The coolant enters the top of the reactor through a plenum, flows down through the fuel assemblies, and exits the bottom of the reactor. A secondary loop of light water cools the primary coolant.

The low-temperature (230 degrees F) and low-pressure (5 pounds per square inch gauge) reactors currently use two types of fuel assemblies, several types of target assemblies (for tritium, plutonium-239, and Pu-238), and one type of blanket assembly (for tritium).

The Mark 16B (for plutonium) and Mark 22 (for tritium) fuel assemblies contain either two or three concentric fuel tubes of highly enriched uranium-235 in an aluminum sleeve housing with an inner lithium target. Depending on the type, the assembly also contains either a permanent or removable lithium-aluminum outer target. These fuel assemblies are used in conjunction with depleted uranium targets to produce plutonium-239, with neptunium targets to produce plutonium-238, or with lithium targets to produce tritium. In the plutonium production mode, some tritium is produced in the lithium blanket assemblies, in the inner targets of the fuel assemblies, and in the control rods.

The Mark 16 fuel is in the reactor for five to six months at full power, and the targets are in the reactor for about one month at full power, according to Roger Rollins, chief of the reactors branch at DOE-Savannah River. The Mark 22 fuel and target assemblies are each good for nine months at full power. Loading of fresh targets takes about five days, and reloading of both fuel and target assemblies takes 10 days. The reactors are in annual maintenance outages that last from 60 to 75 days, Rollins said.

Partial and full-length control rods, made of either cadmium poison or lithium or cobalt for isotope production, control the flux across the reactor core. In an emergency, the reactors can be shut down through the use of safety rods, a gadolinium nitrate poison-injection system, or a computer-generated scram. Three of the cooling loops also could function as an emergency cooling system (ECS) to inject light water in to the top of the core during an emergency.

After 25 years of full-power operation, SRP operator E.I. du Pont de Nemours & Co. discovered that the loss of cooling capability in the fuel assemblies could occur during a loss-of-coolant accident (LOCA), even with the ECS operating, at lower power than previously thought. During a LOCA, the reduced downward coolant flow could be cut off by steam produced from bulk boiling in the core. The power was reduced to prevent bulk moderator boiling, and DOE plans to add a fourth ECS line to each reactor.

DOE also has had problems with oxygen-induced intergranular stress corrosion cracking (IGSCC) because of the large amount of carbon in the stainless steel vessels and piping. Cracks in C reactor's tank were exacerbated by the unique, curved construction of the vessel, which was designed differently than the other reactors in order to allow ultrasonic testing for cracks. The curving and welding stressed the metal before it was irradiated, Rollins said. The cracks in C reactor have defied repair attempts.

DOE's reactors also lack containments. Rather than contain radionuclides, the confinement systems rely on a high-efficiency, particle-air filter to remove particles, a charcoal-bed filter to absorb iodine and halogens, and demisters to remove water droplets, Rollins said. "The filters are designed to remove all radioactivity except for noble gases," such as xenon, krypton, and tritium, Rollins said.

The potential problem with the filters is that they may not withstand the loading that results from a severe accident. Because the source term calculations were done when little was known about radioactive releases, DOE underestimated the amount and form of iodine and the amount of cesium that would be released. The biggest threat to filter integrity would be large amounts of cesium: recent tests on Savannah River fuel have shown that nearly all iodine would be released from damaged fuel and that cesium and iodine will combine into the particulate cesium iodide, which could collect on the filtration unit instead of the charcoal bed.

New HWR Designs In Progress

The industrial proponents of the new HWR designs say they have solved the problems with DOE's SRP reactors. Two industrial teams—from Ebasco, Babcock & Wilcox, and NUS Corp., and from Westinghouse/Bechtel—made presentations to ERAB. DOE also has been designing an improved HWR design with the help of DuPont and Savannah River Laboratory scientists. Both Ebasco and Westinghouse said they could build smaller versions of their proposed designs rather than one large plant.

All the designs are updated versions of the current SRP reactors and would use the same design, fuel, and target technologies and facilities. All would rely heavily on safety codes being developed and validated by DOE for the current SRP reactors, representatives from each team acknowledged—a task complicated by the lack of documentation for the old reactors' designs.

DOE has been designing a new HWR for a number of years, said M.C. Kirkland, director of the DOE-Savannah River project engineering division. It is "basically the same reactor" but would contain "all the safety features we've learned about over the years," he said.

Three changes are being considered. DOE "may go to underwater refueling instead of dry refueling," could add a containment, and might change the direction of coolant flow, Kirkland said. "The downflow does work," he said, "but people thought it (might be) better to have the upflow because natural convection allows the water to rise and allows cooling in a shutdown condition without pumps....We haven't decided whether (the containment) will be rectilinear like a conventional containment building or circular with a dome," he said. "Either one will work and the cost of either is about the same. But it will be a low-pressure containment because of the low temperature" of the system.

According to DOE and industry sources, however, the Ebasco/Babcock & Wilcox/NUS Corp. "enhanced heavy water reactor" most impressed the ERAB panel. The Ebasco HWR would be a four-loop, 2,500-MWt low-temperature (250 degrees F), low-pressure (45 psig) reactor with separate heavy water moderator and coolant loops, according to Robert Iotti, Ebasco's vice president, advanced technology. The reactor vessel and the primary system would be made of Type 316 austenitic stainless steel which, Iotti says, is less susceptible to IGSCC than carbon or low-alloy steels. Tighter control over oxygen concentrations in the primary and moderator circuits, as well as other precautions that can be taken during manufacture and installation, will minimize IGSCC potential, Ebasco said.

The core would use 588 of the current SRP Mark-22 fuel assemblies, except that the outer cladding could be either aluminum or zircaloy. The number of fuel assemblies could be reduced to 504 if DOE decided it wanted to use 84 blanket assemblies to produce isotopes other than tritium, Ebasco's literature says. The target assemblies also would be the same as at SRP. The fuel and target lifetimes would be the same as for the current SRP reactors.

Core power would be controlled by a control rod drive structure using 79 lithium-aluminum control assemblies and 79 inner cadmium poison rods. The design also incorporates 90 safety shutdown assemblies containing gadolinium nitrate.

Tritium would be removed in two streams from the primary coolant and moderator through cryogenic distillation, which permits a "very small but reasonable leak rate into the containment vessel," said Iotti's assistant Vincent Walker. The tritium would be removed from the containment atmosphere by a heating, ventilating, and air-conditioning system that uses air dryers. This tritium control and removal system would result in a plant personnel dose of only 10% of current SRP levels, Ebasco said.

To eliminate potential filter and confinement problems, Ebasco's vessel would be housed in a large, dry, post-tensioned reinforced concrete containment vessel with a steel liner and a design pressure of 60 psig. To control potential hydrogen generated during a severe accident, the design would use a combination of containment sprays, hydrogen recombiners, and hydrogen igniters, Iotti said.

Ebasco plans to conduct level one, two, and three Probabilistic Risk Assessments (PRA) on the design should it land the contract, Iotti said.

Design enhancements have eliminated problems experienced by the SRP reactors, Iotti said. The condition limiting operating power would be resolved in the Ebasco design because the primary coolant would enter the reactor vessel through a downcomer surrounding the moderator and core region, and flow up through the assemblies, as in commercial PWRs, Iotti said. The upper and lower end fittings would be changed to accommodate the change in flow direction, Walker said.

Other issues raised by NAS, including questions related to human performance, liquid effluent releases, and emergency planning would be resolved during the design and licensability review processes, Ebasco said.

Ebasco would plan an annual outage of about 30 days, Iotti said. Total core replacement could be accomplished in 14 days using robotized charging/discharging machines, he said. The remaining 16 days would be used for preventive maintenance and in-service inspection activities, he said. The Ebasco design incorporates two redundant refueling machines and two transfer tubes from the containment transfer pool to the spent fuel pool to minimize possible schedule delays due to machine failure, he added.

The Westinghouse HWR design would be a six-loop, 3,300-MWt plant using the same target design as the SRP reactors but 762 fuel assemblies of 8% enriched U-238. The Westinghouse design would use 210 blanket assemblies containing lithium-aluminum target materials for tritium production. The target materials and fuel would be changed out at 10-month intervals.

Westinghouse also would go to automated refueling equipment to speed refueling and reduce personnel exposures. The reactor tank would be made of type 304L stainless steel, which also has a lower carbon content than the SRP reactor tanks, and Westinghouse also would control water chemistry to inhibit IGSCC.

The major difference between the Westinghouse design and the current SRP reactors is the incorporation of a robust containment with a design-basis pressure of 45 psig. The metal containment would transfer any decay heat through the shell, and the outer surface of the containment would be cooled by a passive air system operating by convection, Vijuk said.

[From Nucleonics Week, July 21, 1988]

WEAPONS TECHNOLOGIES: HOW SAFE IS SAFE ENOUGH?

With a decision approaching on a technology for the United States new defense materials production reactor, Nucleonics Week's Danialle Weaver examined the opinions being given DOE. This is the second of her two-part report.

DOE's scheduled August 1 decision on a new weapons materials production reactor (NPR) has sent industrial teams scrambling for the contract, worth $5- to $10-billion and the largest U.S. nuclear plant order in the near future.

DOE says it will pick a new reactor technology by giving equal weight to the goals of production efficiency and safety. But an Energy Research Advisory Board (ERAB) panel, which reviewed several designs for DOE, recommended DOE opt for a heavy-water reactor (HWR), built next to the existing but shut-down HWRs at the Savannah River Plant (SRP), to attain quick tritium production (NW, 9 June, 1). The report contradicted earlier studies showing that all the technologies, including the passively safe designs, had roughly the same construction times.

But all of the technologies entail schedule risk. For the HWR, the risk is in the safety review process. DOE is developing policies on safety objectives, severe accidents, and probabilistic risk assessments (PRAs) in response to the first-ever outside review of the SRP reactors. The safety effort, begun in fiscal year 1988, will take four years and $12-million to develop, according to DOE documents. Each new HWR design would use the safety codes to be developed in that program. The SRP codes, which use revised commercial industry codes as a base, must be recalculated for their higher fuel enrichments, lower operating pressures, and heavy water moderation. Other complications include missing documentation for the SRP reactors and proposed HWR design changes reversing the direction of coolant flow (NW, 14 July, 9).

For the other designs—LWRs, modular high-temperature gas-cooled reactors (MHTGRs), and liquid metal reactors (LMRs)—the schedule risk lies in development of tritium production capabilities. All the designs have been or will be reviewed by NRC for safety, but they are unproven tritium producers, though the MHTGR has what is considered the most mature technology. Proving that capability could delay those reactors, ERAB said.

DOE should consider an advanced reactor despite potentially higher costs, ERAB said. All the non-HWR concepts could sell steam to offset costs. The MHTGR and the LMR would advance nuclear technology more than a HWR or even a large LWR, the panel said. The MHTGR and LMR and, to a lesser extent, a small LWR, are "passively safe" designs that rely on gravity and natural convection and circulation, rather than operator intervention, for shutdown. The smaller, modular designs should cut costs and reduce hasty design changes.

But linking LWRs to weapons is a connection many in the industry want to avoid. The two LMR proponents, who are also trying to avoid that connection, have sacrificed efficient breeding ratios for bigger safety margins. And Public Service Co. of Colorado's (PSC) Fort St. Vrain, the only U.S. commercial HTGR, has been plagued with operational problems, although the plant was taken off NRC's "problem plant" list last week.

DOE officials, who openly prefer the HWR, have argued that they cannot gamble the nation's nuclear deterrent on unproven technologies. Proponents of non-HWR technologies argue that DOE must upgrade its public image by choosing a "safer" reactor. What is clear, say DOE observers, is that the ERAB panel told DOE exactly what it wanted to hear. It is also clear that the reactor safety debate is far from over.

MHTGRs: Will the technology work?

The MHTGR, which by most accounts presented the only serious challenge to the HWRs, impressed the ERAB panel because of its passive safety features, the maturity of its target technology, and the ability of its modular construction to provide redundancy and flexibility in materials production, sources said.

General Atomics' (GA) MHTGR would consist of eight, 135-MW, helium-cooled, graphite-moderated modules. Each module would contain a carbon steel reactor vessel, an interconnecting crossduct, and a vessel housing a helical coil steam generator and a motor-driven main helium circulator. Each module would have its own turbine, which would allow production of different isotopes as well as staggered refueling and target changeout times. The carbon steel would not exhibit the intergranular stress corrosion cracking shown in the SRP reactors because the MHTGR system does not contain water, GA said.

According to Linden Blue, GA's vice chairman of the board, every performance problem experienced by Fort St. Vrain has been linked to the unique design of the helium circulators. The Fort St. Vrain circulators have bearings that are cooled by water, rather than oil, which has resulted in water leakage into the helium coolant. The bearings for the proposed circulators would be conventionally cooled, Blue said.

The fuel would consist of highly enriched uranium dicarbide particles with a TRISO coating consisting of three layers of pyrolytic carbon, silicon carbide, and pyrolytic carbon. The coating is designed to retain fission products. The particles are mixed with graphite, formed into fuel rods, and inserted into graphite blocks to make fuel elements. A total of 660 fuel elements make up one module's core. The fuel is identical to that used in Fort St. Vrain and has performed well, according to PSC. The fuel has a design life of three years; there is no degradation of the fuel up to 3,600 degrees F.

GA's target technology, the most advanced of all the non-HWR concepts, would use TRISO-coated lithium aluminate kernels. The coating retains tritium, which diffuses rapidly through most materials. The target particles are mixed with graphite, assembled into graphite sleeves, and inserted into the fuel assemblies. The tritium targets are designed to last six months and retain their integrity up to the same temperature as the fuel.

GA anticipates a two-week maintenance and inspection outage each time the targets are removed, Blue said. The reactor is refueled through control rod drive penetrations in the top of the vessel. A refueling machine is inserted into the penetrations and entire graphite blocks—one-third of the core—are removed and replaced. The removal of the entire block every three years precludes the neutron-induced graphite distortion that plagued DOE's Hanford, Wash., N reactor, Blue said (NW, 18 Dec. '86, 7).

The tritium recovery technology consists of crushers to fracture the target particles and a vacuum furnace with a purification system. Reprocessing of driver fuel could make major use of existing facilities at SRP and the Idaho National Engineering Laboratory (INEL), GA said.

The two key passive safety features of the MHTGR, Blue said, are passive decay heat removal and a negative temperature coefficient. Decay heat would be dissipated from the core by conduction and radiation to the silo cooling system or to the surrounding earth. The large negative temperature coefficient would shut the reactor down in the event of a loss of forced circulation at full power. At Fort St. Vrain, forced circulation could be lost for 18 hours without fuel damage (NW, 15 Oct. '87, 8).

The reactors would be housed in underground silos, with the "containment" being unlined reinforced concrete horizontal blowdown tunnels designed for a maximum 15 pounds per square inch gauge (psig). The low contained energy within the system would preclude a breach of the tunnel containments, Blue said.

LWRs: Building on a technology base

The LWR technologies have a theoretical advantage because of their widespread use in the commercial power industry, ERAB said. The problem with the LWRs is that they lack a proven technology for producing tritium, sources said.

A Westinghouse/Bechtel team, which also proposed an HWR concept, proposed two technologies: a "special water reactor" (SWR) based on the design of Union Electric Co.'s Callaway, and conversion of the Washington Public Power Supply System's (WPPSS) mothballed WNP-1. Late in the selection process, ERAB also considered a small, "inherently safe" Westinghouse spin-off of its AP-600 concept, called a Small Advanced Special Water Reactor (SASWR). The SASWR would be redesigned for weapons production, according to Robert Vijuk, Westinghouse's manager of space, defense, and nuclear programs.

The SWR would be very similar to Callaway, a four-loop, 1,170-MW (net) PWR. The SASWR would be a two-loop, 700-MW (net) modular PWR. Like the AP-600, the SASWR would have fewer valves, fewer large pumps, and less piping than current LWRs. The SASWR would rely on passive safety injection systems, passive decay heat removal systems, and passive containment cooling using gravity and natural convection.

The SWR would use a 19x19 zircaloy-clad fuel assembly, but the uranium would be 8.5% enriched. Callaway's fuel is in a 17x17 zircaloy-clad assembly and is 2% to 5% enriched. The SASWR also would use 19x19 fuel assemblies, but the fuel enrichment would be 8.8%. WNP-1 is designed to use 17x17 fuel assemblies, but the enrichment would be upped to 10%.

The fuel for each reactor would have a three-year life, with one-third of the core changed out at each refueling. Westinghouse began its SWR design using highly enriched uranium, but the enrichment was gradually lowered to 8.5% to preclude recriticality problems, Vijuk said.

The ceramic lithium-aluminum target rods would be contained in a stainless steel tube with a tritium diffusion barrier and a getter in the tube to retain the tritium during irradiation. Westinghouse has tested small-scale targets in INEL's Advanced Test Reactor (ATR) and would test full-length simulated targets in an operating commercial reactor, Vijuk said. The targets would have a one-year lifetime. Unlike GA's targets, the Westinghouse targets have not been demonstrated, although the target concept is feasible, Vijuk said.

Westinghouse anticipates 42 days per year outage time for target change-out, refueling and maintenance for its SWR concepts. The company expects an annual 80% availability rate for all its LWR concepts, Vijuk said.

A disadvantage for the LWRs is that they would require new fuel fabrication facilities, assuming that DOE wanted that capability on-site, Vijuk said. Otherwise, he said, the fuel could be fabricated in existing commercial or government fuel facilities. "The targets could be fabricated anywhere," he said, but tritium extraction facilities would have to be built.

The SWR design, through the Callaway plant, is 100% complete, "so we have complete plant drawings and specifications, and only the changes need to be engineered in the same detail," Vijuk said. The SASWR is still a concept. The SWR reactor vessel would be slightly larger than Callaway's, and there are other, minor differences, he said.

WNP-1, a 1,250-MW Babcock & Wilcox PWR, would appear to be a perfect solution to DOE's current dilemma: at the 63% completion level, the plant's major systems have been installed, and the reactor's design is 98% complete. WPPSS has been careful to keep a skeleton maintenance crew on site to keep up the plant, so the reactor could theoretically be brought on line in five years, or half the estimated time required to build a new reactor from scratch. WNP-1 is located on federal land at DOE's Hanford reservation and could use the N reactor's work force. A Bechtel study last year concluded the conversion was feasible, and the company had proposed finishing the plant on a $1.6-billion fixed-price contract.

But WPPSS sold $2.1-billion in bonds to finance the plant, and any attempt by DOE to purchase or otherwise acquire the unit could result in bondholder litigation that could tie the issue up in court for several years (NW, 22 Oct. '87, 2) and dramatically increase DOE's costs. And, although the Arms Control & Disarmament Agency and the State Department have said that the conversion would not violate U.S. law or treaty obligations, significant political opposition to the conversion of a commercial reactor exists.

LMR Advocates: We're Not Interested

DOE requested early this year that General Electric and Rockwell International make presentations to the ERAB panel on their proposed commercial LMR designs, which are sponsored by DOE. But the companies would just as soon not have their reactors linked to weapons production, as were earlier liquid metal fast breeder reactors. GE's reactor would not breed, and Rockwell's literature makes only a passing reference to a "breeding ratio slightly greater than unity to make up for fuel cycle losses." Both reactors rely on the inherent safety features of liquid sodium as a coolant and use natural convection for decay heat removal.

GE's Power Reactor Inherently Safe Module (PRISM) would be a 1,395-MW (net) pool-type reactor plant consisting of three, 465-MW power blocks. Each block would consist of three 155-MW modules, which include a nuclear steam supply system and a turbine, so targets could be changed in one module while the rest operated, providing the production flexibility so attractive in the MHTGR.

The reference commercial fuel is Argonne National Laboratory's (ANL) metallic fuel, although oxide fuel could also be used. Like the MHTGR, the reactor would be housed in an underground silo, and the reactor module would be factory-fabricated and shipped to the site in one piece.

Rockwell's Sodium Advanced Fast Reactor (SAFR) would be a 1,800-MW pool-type plant consisting of four, 450-MW modules. SAFR also would use metallic fuel, but could use oxide fuel as well. The reactor would be housed above grade, fabricated in a factory, and shipped to the site in one piece.

"DOE is our customer, and our customer requested that we make the presentation," said Robert Bergland, GE's manager of advanced nuclear technology. "But we're not interested."

"Both SAFR and PRISM are being proposed and advocated as super-safe advanced systems for electric power generation," said Richard Oldenkamp, director of power plant projects for Rockwell's Atomics International Rocketdyne Division. DOE might want to use a LMR design

SAFETY CONSIDERATIONS IN SELECTING A NEW PRODUCTION REACTOR

AUTHORS: ROGER J. MATTSON AND JAMES F. MEYER

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EXECUTIVE SUMMARY

Introduction

This is an assessment of how the consideration of safety assurance should factor into the choice of technology for the New Production Reactor (NPR). It was prepared by two individuals experienced in the safety analysis and licensing of nuclear power plants, namely James F. Meyer and Roger J. Mattson. Their credentials are summarized in Appendix A.

The purpose in obtaining the regulatory perspective provided in this report is to put greater emphasis than has been given to date on an important factor in the choice of NPR technology, namely, the demonstration that the technology is safe enough. The Department of Energy has articulated its commitment to safety in stating that the new production reactor will provide a level of safety that is at least equivalent to that of the best of current commercial power plants. But there is more to the safety issue than just this overriding objective. That is, in implementing its safety commitment, DOE will find that ***the demonstration of safety is highly important*** because it can introduce controversy into the NPR program, potentially adding significantly to its costs and, more importantly, delaying the startup of the facility.

To illustrate how significant the safety controversy can be for the deployment of nuclear plants, it is useful to recall the effect of safety deliberations on the light water power reactors in the United States. Changes in safety regulation that were intended to increase the level of safety and the assurances of safety have been responsible for most of the cost escalation and delay of the light water nuclear power plants built in the U.S. since the accident at Three Mile Island. The delays have amounted to several years on most recent nuclear power plants. Such delays may be critical to the purpose underlying the choice of technology for and construction of the new production reactor--the critical need for goal quantities of tritium.

If this record of cost escalation and delay has occurred for a well established technology, and if the safety requirements for the commercial plants are to be copied for the NPR, which they most surely will be, then it is critical that those making the decisions about the choice of technology for the NPR give careful consideration to the technical basis that is or will become available to demonstrate the safety of that technology. This paper is an initial attempt to compare the present and future capabilities for the alternative technologies to demonstrate adequate safety assurance.

Summary of the Report

In the report that follows, ***five questions are addressed*** as follows.

1. What is adequate safety assurance for the new production reactor, and how does that compare with licensed nuclear facilities?

2. What are the process options available to DOE to provide adequate safety assurances for the NPR?

3. What is the expected safety assurance process, and what are the desirable NPR technology attributes?

4. What has been the history of safety assurances for severe accidents?

5. What are the possible solutions to any problems expected in providing adequate safety assurances for the NPR?

The ***principal conclusions*** of the report are as follows.

When the alternative technologies available for the new production reactor are viewed from the perspective of these questions and from the perspective of providing the highest probability of demonstrating adequate safety in a timely and broadly acceptable fashion, certain conclusions can be drawn. The Heavy Water Reactor presents the highest risk because of the lack of regulatory background and the uncertainties surrounding severe accidents. The High Temperature Gas Cooled Reactor has significant advantages over the Light Water Reactor, the Liquid Metal Reactor, and the Heavy Water Reactor. It has a better technical basis for responding to determined intervention, it has a proven track record in the NRC licensing process, and it has lower severe accident risk.

Stepping back from the perspective of safety assurance of the NPR per se and considering some broader issues that affect safety of nuclear power in general in the United States, several further points are appropriate, all of which further support choosing the HTGR technology for the NPR.

- The federal budget for nuclear technology, apart from the production of nuclear defense materials, has been relatively constant for several years, and all safety research has come out of that budget, whether it is for commercial power or for DOE and military applications. If the decision is made to go with the HWR, it will require large safety expenditures for a technology unique to the NPR, thus diverting needed funds from other important safety research programs. It could detract from reactor safety research applicable to the commercial sector.

- Both the commercial and the military applications sectors could benefit considerably from a shared safety technology. Safety information developed for the commercial reactors could be of use by the NPR and vice versa. The advantages of sharing safety technology cannot be over estimated. This could not happen if the HWR was chosen as the NPR.

- It has been said that choosing a technology other than the HWR would compromise the distinction between nuclear reactors for weapons production and nuclear reactors for power production. This argument may have some merit for one of the LWR candidates for the NPR because that candidate is a pressurized water reactor that was initially designed and built for commercial applications. However, it is worth noting that the pressurized water reactor technology now used around the world evolved from the U.S. Navy's nuclear propulsion technology.

- Finally, DOE, through its NPR program could make a significant contribution to the future energy security of the United States by choosing a reactor type that has potential to meet future energy needs in a safe and environmentally acceptable way. In this way, the Department also will serve to limit the number of nuclear reactor designs in the United States. This is a problem of safety significance that has plagued the country for a generation and that the Energy Research Advisory Board has urged the Department to solve.

The bases for coming to the conclusion that the HTGR is the preferred technology when viewed from the safety assurance perspective are as follows:

- There is a ***new era*** for demonstrating safety of nuclear plants in the United States and throughout the world. The four key elements of this new era are:
    - A complex and exhaustive safety assurance ***process*** is embodied in the policy and practice of the U.S. Nuclear Regulatory Commission (NRC). Since the accident at Three Mile Island in 1979 and subsequent construction problems at several U. S. plants, there are new expectations of the level of safety to be achieved and of the degree of safety assurance to be provided for nuclear power plants. These increased expectations of safety have spread around the world, especially in the aftermath of the accident at Chernobyl in the Soviet Union in 1986. There is no presently acceptable alternative to the type of safety assurance process that has been set in place for commercial nuclear power plants. ***It is our view that DOE has no choice but to conform to the essential features of this process.***

    - The ***public and Congress*** will have a major voice in the determination that the NPR is safe before it is built or operated. DOE facilities of this size and visibility are no longer insulated from public and congressional safety perceptions and scrutiny. ***Substantive response to Congressional and public concern for safety will be important to timely construction of the NPR.***

    - Issues associated with ***severe accidents*** are more important now than they have been in the past. Protection of public health and safety requires that the probability and consequences of severe accidents be controlled. The public must also be assured, especially after the accidents at TMI and Chernobyl, that the severe accident risks are adequately addressed. In this regard, experience has shown that the actual risk of a new facility may not be as crucial to the acceptance of the facility as the uncertainties and unknowns regarding that risk. This is because a known risk can be properly factored into the design and siting decisions. It is much more difficult to reach consensus decisions when major uncertainties cloud the risk picture. ***In order to minimize schedule risks, and thereby national security risks, DOE must assure that severe accident issues are addressed clearly and in a forthright manner and that the technology chosen for the NPR minimizes these uncertainties.***

    - Policy for new reactors world wide is emphasizing ***simplicity*** and ***inherent safety***. The present light water reactors are too complicated and too dependent on active safety systems to be accepted in large numbers in the future. Virtually every advanced reactor design is striving for simplicity and safety that is not as dependent on operators or machinery as current designs. ***The choice of technology for the NPR should accommodate this new policy.***

- The choice of NPR technology from the available alternatives must address the four key elements comprising the new expectations in safety assurance. In addition, the potential for conflicts and delays associated with providing safety assurance can be reduced by selecting a technology for the NPR that has been ***tested and found acceptable by use of current safety assurance methods***. Such a technology provides a more certain foundation for future success in the NPR program than does a technology for which there is only a ***commitment to conform to current safety criteria*** and no experience to show what it will cost or how long it will take to achieve consensus that the design is acceptable. Thus, the attributes of a NPR that would reduce the potential for future conflicts and delays are as follows:

- Regarding the safety assurance ***process***, the most important attributes would be: (a) experience with the current licensing methods and criteria, (b) accommodation of lessons learned from the licensing process, and (c) a base of technical knowledge and experience, outside of the vendor and DOE, with the physics and engineering, and performance of the design.

- Regarding the ***public and Congress***, the key attribute would be incontrovertible evidence that safety assurance will be provided. This requisite demonstration of safety may have little to do with a reasonable technical proof of safety. Rather, the safety perceptions of a concerned public must also be addressed, and what will convince the concerned public is not so much the low probability of severe accidents as the demonstrably low consequences of a severe accident, should one occur.

- Regarding ***severe accident*** risks, the most important attributes would be: (a) the risks have been assessed by the best available technology and peer reviewed, (b) the risks are small, (c) the uncertainties regarding the most important accident sequences are small, and (d) there is experience with controlling the contributors to severe accident risks in the construction and operation of the technology.

- Regarding ***simplicity and inherent safety***, the most important attributes would be: (a) a relatively long time available to make decisions in the event of a serious incident, (b) the lack of safety dependency on ac power or on active mechanical and electrical systems, (c) the availability of passive reactivity control under all conceivable conditions, and (d) low power density.

SAFETY CONSIDERATIONS IN SELECTING A NEW PRODUCTION REACTOR

This is an assessment of how the consideration of safety assurance should factor into the choice of reactor technology for the New Production Reactor (NPR). It was prepared by two individuals experienced in safety analysis and licensing of nuclear power plants, James F. Meyer and Roger J. Mattson. Their credentials are summarized in Appendix A.

The purpose of obtaining the regulatory perspective provided in this report is to put greater emphasis than has been given to date on an important factor in the choice of NPR technology, namely, the demonstration that the technology is safe enough. The report shows that the demonstration of safety will have an important bearing on the implementation of the new production reactor. The report also establishes that there are differences among the alternative technologies in terms of uncertainties in demonstrating their safety. These uncertainties mean that there is varying potential among the alternative technologies for cost increases and schedule delays in bringing the NPR into operation. For this reason, the safety assurance questions deserve consideration in selecting the technology.

The report is structured so as to answer five questions about the safety assurance process, as follows:

1. What is adequate safety assurance for the new production reactor, and how does that compare with licensed nuclear facilities?
2. What are the process options available to DOE to provide adequate safety assurances for the NPR?
3. What is the expected safety assurance process, and what are the desirable NPR technology attributes?
4. What has been the history of safety assurances for severe accidents?
5. What are the possible solutions to any problems expected in providing adequate safety assurances for the NPR?

The five questions are addressed in the five numbered sections of the report. The four alternative technologies addressed in the report are Heavy Water Reactor (HWR), Light Water Reactor (LWR), Liquid Metal Reactor (LMR), and High Temperature Gas Reactor (HTGR).

1. What is adequate safety assurance for the new production reactor, and how does that compare with licensed nuclear facilities?

Introduction

The questions of (a) what constitutes adequate safety assurance for the New Production Reactor (NPR) and (b) how does that compare to the safety assurances now required of nuclear power plants are important in selecting the technology to be utilized for the NPR. It is possible to answer these questions, but it is not straightforward, and the answers have an element of uncertainty. What constitutes adequate safety for existing and future production reactors in the United States is uncertain at this time because the definition of adequate safety is changing. The source and status of the changes are briefly summarized in this section.

In the mid 1980's, the Department of Energy (DOE) began a series of more critical self-examinations of the safety of its production reactors and other facilities than had been conducted in the past. In 1986, as an outgrowth of these more critical self-examinations and just prior to the accident at Chernobyl in the Soviet Union, DOE set in motion a new program for Technical Safety Appraisals of its facilities. After the Chernobyl accident, DOE accelerated the TSA program and added some other types of facility reviews, including design reviews and management appraisals.

In May 1986, DOE also asked the National Academy of Sciences and the National Academy of Engineering to provide an independent assessment of the implications of the Chernobyl accident for the safe operation of 11 of the Department's larger reactors. In response, the Academies formed the Committee to Assess Safety and Technical Issues at DOE Reactors. The Committee issued a report on the "Safety Issues at the Defense Production Reactors" in late 1987. While recognizing that DOE's management responsibility included more than the assurance of safety, the Committee recommended fundamental and significant changes in DOE oversight of safety of the existing production reactors.

As a result of the report of the National Academy of Science and the National Academy of Engineering and consistent findings from other safety appraisals, the safety programs for the existing production reactors have been changing significantly. There is no doubt that these changes will affect the safety assurances required by DOE of the designer, constructor, and operator of the NPR. The selection of technology for the NPR should give consideration to these recent changes in DOE's safety assurance expectations and to the cost and policy implications of future efforts to comply with the new and still evolving DOE safety mandate. Prudence probably will require DOE to re-examine recent thinking about the NPR technology in light of a full understanding of the substantial consequences to national security that could result from a false start in selecting a demonstrably safe technology.

Role of Policy and Practice for Commercial Nuclear Power Plants

The Nuclear Regulatory Commission (NRC) and its predecessor, the regulatory staff of the Atomic Energy Commission, have been overseeing the safety of commercial nuclear power plants in the United States for nearly 30 years. The safety regulations are well defined in Chapter 10 of the Code of Federal Regulations. For example, the siting criteria were prescribed in 10 CFR in about 1962, the General Design Criteria in 1970, and the Quality Assurance requirements in 1970. Since those fundamental requirements were put in place, there have been significant additions to the safety regulations to address such issues as fire protection, seismic design, environmental qualifications of safety related equipment, hydrogen control during accidents, effluents of radioactive materials during normal operation, use of commercial codes and standards, emergency preparedness, emergency core cooling, and enforcement policy. A comparable evolution of DOE safety requirements for production reactors has lagged well behind the commercial sector.

Although DOE has Orders which contain safety requirements for DOE reactor facilities, and the Orders are similar in some respects to regulations for commercial plants, the Orders have been found to be inadequate by the National Academy and other studies, and the Orders are significantly incomplete when compared to the basic regulations in 10 CFR. Furthermore, the production reactors at Savannah River and Hanford have never been systematically reviewed against the presently inadequate DOE Orders, nor have they been compared against NRC regulations. In fact, the Savannah River reactors were intentionally exempted from DOE Orders until early 1987, and no DOE review of their compliance has yet been conducted. Thus, neither the heavy water technology at Savannah River nor the pressure tube technology at Hanford has ever been evaluated against current licensing methods or criteria. In contrast, the liquid metal reactor technology and the high temperature gas technology have been undergoing extensive NRC reviews as advanced commercial reactors for the past several years, and both of these technologies are confident of NRC acceptance. In fact, NRC and DOE have made significant progress in establishing General Design Criteria for the LMR and the HTGR, drawing on regulatory experience with LWR technology. There is no comparable progress in NRC or DOE for the heavy water reactor.

There are other NRC requirements that are even more highly developed than the General Design Criteria contained in the Code of Federal Regulations. Over the years NRC has refined its requirements through the review of over 120 light water, liquid metal, and gas cooled reactors. The years of licensing experience have resulted in the promulgation of many Regulatory Guides and standard review plans. There is no comparable body of DOE standards. As a result, neither the heavy water technology nor the pressure tube technology has ever been subjected to evaluation under the more detailed and prescriptive licensing requirements of NRC. As any owner of a commercial light water reactor or gas cooled reactor can attest, obtaining consensus agreement that their designs met the NRC requirements was a costly process, fraught with controversy and, in recent years, significant delay. DOE and NRC have already made significant progress in establishing which of the more detailed NRC guidance documents apply to the LMR and HTGR technologies. There is no such progress for the HWR.

There has been another important uncertainty in reactor safety regulation in the past ten years for commercial light water reactors. The uncertainties stem from the low probability but nevertheless important possibility of severe accidents. These uncertainties for light water reactors have been most difficult to dispel. Thus, to say that the heavy water reactor has about the same severe accident risk as light water nuclear power plants is to condemn that technology with faint praise. The advanced LMRs and HTGRs have already demonstrated significant risk reduction relative to current nuclear power plants.

NRC policies, practices, and requirements set the norm for what is expected for safety assurances in the United States, indeed for much of the world. International safety standards have been established in general agreement with U.S. requirements. Where other nations disagree with the U.S. standards, it is usually in the direction of providing even further safety features. The filtered vents, extra emergency power, and accident management procedures of the European countries are the most striking examples.

Since the methods used in licensing commercial plants are the norm, and since the same U. S. citizens concerned with the safety of current nuclear power plants will also be concerned with the safety of the new production reactor, it should be expected that no less than the NRC methods will be demanded of the NPR technology. In fact, those expectations have already materialized in that the Department of Energy has begun to adapt many of the NRC methods to its own facilities and uses.

Safety Policy and Technical Issues That Will Arise for the NPR

If it is accepted that the NRC policies and practices set the norm or perhaps a minimum for what will be required for a safety demonstration for the new production reactor, then it is useful to examine some of the more important details of NRC policies and practices for design and safety analysis to see what issues may arise for the NPR.

Although the following discussion concentrates on the design and analysis aspects of safety, this is not to say that the construction and operational aspects of safety that NRC has begun to emphasize in recent years are less important. In fact, construction and operating experience under current NRC expectations should figure in the decision on the NPR, but that factor is not addressed herein. It is the view of the authors that if such factors were included, the conclusion of this report would not change significantly.

Some of the more significant policies of the Nuclear Regulatory Commission that will figure directly or indirectly in the demonstration of safety for the new production reactor are the following:

1. General Design Criteria - General Design Criteria were established in the NRC regulations for light water reactors in 1970. They have remained relatively unchanged since that time. They provide the basis for most of the detailed technical requirements that are issued by the NRC, and they no doubt will continue to figure prominently in safety decisions in this country for many years to come. These criteria were adapted to liquid metal technology for the licensing review of the Clinch River Breeder Reactor and by the Atomic Energy Commission to gas-cooled reactor technology for the licensing review of the Ft. St. Vrain reactor. In the case of the advanced commercial HTGR, the Department of Energy has proposed an alternative approach to the General Design Criteria in the form of "top level criteria" that are not completely developed or approved. There are no General Design Criteria for any HWR in the United States.

2. Advanced Reactor Policy - On March 26, 1985, the Nuclear Regulatory Commission issued for public comment a "Proposed Policy for Regulation of Advanced Nuclear Plants" (50 FR 11884). A final version was published by NRC on July 8, 1986. The policy addresses a number of important regulatory concepts, including the defense-in-depth philosophy of reactor design; safety goal policy; severe accidents; use of existing regulations, guidelines and industry standards; and supporting technology. The policy describes what NRC expects will constitute the requisite safety assurances for advanced reactors. Commercial LMR and HTGR designs have been under review by the NRC using this policy statement on advanced reactors as a guide since at least four years ago when the NRC staff

had the policy under development. Thus, HTGR and LMR technologies benefit from being reviewed under even the most developmental of regulatory methods and criteria while heavy water technology has had no systematic review against regulatory requirements. The two LWR candidates for the NPR, a B&W pressurized water reactor for which a construction permit was issued in 1975 and a Westinghouse pressurized water reactor, are not advanced reactors.

3. Safety Goal Policy - On August 4, 1986, the NRC published a policy statement on "Safety Goals for the Operation of Nuclear Power Plants" (51 FR 28044). It concentrates on the radiological risks to the public from nuclear power plant operation and establishes goals that broadly define an acceptable level of risk. NRC staff is developing specific guidelines to establish a consistent level of risk between licensing criteria for advanced reactors (they have LMRs and HTGRs under review) and the safety goal policy. DOE has begun to develop a comparable safety objective for its facilities. When the DOE safety objective has been established, work could begin to develop specific guidelines for the various types of DOE facilities that would be evaluated against it, such as the heavy water reactors at Savannah River or the NPR.

4. Severe Accidents and Probabilistic Risk Assessments - The NRC's 1985 "Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants" (50 FR 32138) has a number of provisions that apply to advanced reactors. The commercial LMR and HTGR designs are being reviewed by the NRC against those provisions. One of the more significant provisions is the requirement that all new designs submitted to the NRC for approval must have implemented a probabilistic risk assessment (PRA) of the type performed by Rasmussen in the mid-1970's for the so-called Reactor Safety Study and refined in a number of ways since that time. Although the HWRs at Savannah River have been undergoing a PRA for several years, that assessment has not yet been subjected to DOE review. As to the heavy water reactor proposed for the NPR, since the design is still conceptual, it will not be possible to undertake any meaningful PRA for several years until more design details are available. Thus, any severe accident weaknesses that such a PRA will disclose (they normally do) could not be factored into such an HWR design and schedule for several years to come. The Severe Accident Policy Statement also requires that severe accident analyses be performed for new designs, irrespective of the low probability of such accidents, so as to understand the potential for large releases of radioactive materials. Although the technology for such deterministic analyses of severe accidents is established for light water reactors, liquid metal reactors, and HTGRs, it is not well developed for the HWR. This lack of severe accident understanding for the heavy water reactor may be particularly important since the report of the National Academies of Science and Engineering in 1987 identified the potential for a core melt recriticality accident leading to a runaway power excursion "like that at Chernobyl" that could occur in the Savannah River reactors. The HWR design proposed for the new production reactor has not yet been examined in this light, to our knowledge.

Some of the more significant technical issues that may arise in the demonstration of safety for the new production reactor can be foreseen by reviewing key regulatory practices of NRC, as follows:

1. Design Basis Events - Design basis events are used in the licensing of nuclear power plants to provide reasonable assurance that

unexpected occurrences in the life of a plant are considered in the design and would not present a significant safety risk. The design basis events for licensed light water reactors, the HTGR at Ft. St. Vrain, the cancelled Clinch River Breeder Reactor, and the Fast Flux Test Facility and the ongoing reviews of advanced LMR and HTGR designs by the NRC serve to establish regulatory precedent for the selection of these events for LWR, HTGR and LMR technology. There has been no comparable regulatory precedent established for the heavy water reactor.

2. Design Complexity and Reliability - It is well known that light water reactor technology has grown to be very complex, in part because of all the safety systems that have been required to be backfit to the licensed plants. Advanced nuclear power plant designs seek to increase plant reliability (a concern for both increased safety and increased availability) by reducing the complexity of the plant systems and the complexity of the actions required to build, operate, and maintain them. High value is being placed on the simple, passive safety systems that are proposed for the advanced HTGR and LMR plants that are now under review by NRC. In contrast, the safety systems of the heavy water reactors at Savannah River have grown complex by being backfit a number of times, and the system performance has become so controversial that the reactors have been de-rated for more than a year. (De-rating of course is not unique to the HWR as NRC has required de-rating in the past for LWR and HTGR units.) As a result, the new HWR design, while incorporating some features to resolve some of these problems, still must depend on active, complex, and engineered safety systems much the same as is required for the LWR. It remains to be seen whether these safety systems increase or decrease the complexity and reliability of the HWR.

3. Containment and Accident Source Terms - NRC has requirements that light water reactors be provided with substantial, leak tight containment structures to confine radioactive material that might escape from the reactor. The NRC has not required such a containment for the Ft. St. Vrain HTGR. Also, the proponents of the advanced LMR and advanced HTGR power plants have proposed that their backup safety systems are so reliable that containments are not needed. There are confinement buildings for the heavy water reactors at Savannah River, but they would not be acceptable as containment buildings under NRC regulations. Thus, neither the HTGR nor the HWR technology proposed for the NPR has any experience in meeting modern containment requirements. The Department of Energy has already announced that the NPR will be required to have a containment building. This is a correct and an exceedingly important decision for assuring public acceptance for all of the technology options discussed herein.

4. Human Factors - The accident at Three Mile Island significantly increased the attention paid in licensing and inspection of nuclear power plants to the human factors involved in safety assurance. The effect of this increased attention on human factors insofar as the advanced commercial reactors (LMR and HTGR) are concerned has been to place high value on such things as inherent safety. Inherently safe characteristics of a design are those that cause the plant to revert by natural forces or laws of physics to safe states when they are upset from normal conditions. The inherently unstable power characteristics that made the Chernobyl accident so devastating are an example of why inherent safety is desirable. Inherent characteristics that are of interest to the NPR that should be considered in the choice of the technology include power density of the core and the heat capacity of the reactor (which determine the

relative rapidity with which the plant responds to upset conditions) and the complexity of the actions required by people and hardware to control upset conditions and respond to new conditions of the reactor. The HWR technology is at a disadvantage in this area because DOE has never had any human factors requirements and therefore the HWRs at Savannah River have not been subjected to the scrutiny that the HTGR, LWR, and LMR technologies have received in recent or ongoing regulatory reviews. Human factors are likely to be a significant issue for the HWR since, like the LWR, it depends on operator controlled and maintained active safety systems to achieve the requisite levels of safety performance.

5. Emergency Planning - NRC has established detailed requirements for emergency planning in its regulations and guidance documents. These requirements were increased significantly after the accident at Three Mile Island, and they have been controversial and costly to implement. In two cases they have stood alone as the reason that otherwise finished plants were not allowed to go into operation. The HTGR at Ft. St. Vrain is exempt from the 10 mile planning radius required by NRC regulation (10 CFR 50.47) because of its lower potential for harm to people located offsite; it has a five-mile planning radius. The advanced HTGR and LMR designs under review by the NRC claim that emergency planning requirements may be reduced for their sites, and NRC is giving those proposals serious consideration. Indeed, the NRC staff recently took the position with the Advisory Committee on Reactor Safeguards (ACRS) that no offsite evacuation planning need be required for the modular HTGR. The understanding of potential accident source terms and accident progressions that are needed for decisions on emergency planning are better developed for the LWR, LMR, and HTGR than they are for the HWR because the HWR has not been subjected to the same regulatory scrutiny at Savannah River as the other technologies have received in the NRC process.

2. What are the process options available to DOE to provide adequate safety assurances for the NPR?

There are a number of ways to implement the technical requirements that will apply to the new production reactor. They are examined in this section by identifying four potential alternatives that cover the range of reasonable choices. The actual process eventually chosen by DOE in consultation with the Congress may be a combination of these alternatives.

The alternatives are as follows:

1. NRC Regulation of the NPR - Congress could require NRC to regulate defense nuclear facilities, such as the new production reactor. Both NRC and DOE have resisted this role for the NRC, and it is not a likely alternative. The NRC process is distinguished by high technical content, technically competent licensing and inspection staff, highly developed system of requirements and guidance, two step licensing review and approval, mandatory public adjudicatory hearings at the construction permit stage, opportunity for a public hearing at the request of the public at the operating license stage, and two step technical review by the Advisory Committee for Reactor Safeguards (ACRS). The NRC review is of an audit type wherein the technical staff samples the analyses, design, fabrication, and documentation to determine whether the applicant is systematically implementing all of the NRC requirements; i.e., the NRC review and inspection does not cover every aspect of every safety related feature of a plant. Rather, the applicant is expected to a have programs to assure that all safety systems are built and operated in accord with the safety requirements.

2. NRC Advice on the Safety of NPR - In the past, DOE has requested NRC review of some or all aspects of safety of certain DOE facilities, including research reactors like FFTF and LOFT, and naval nuclear prototypes. The NRC typically reviewed such facilities against NRC requirements and advised the DOE staff of any significant differences. DOE made any decisions about the necessity for design change. The ACRS was involved in the review process. Except for the naval prototypes, the reviews were documented in NRC Safety Evaluation Reports that were publicly available, but there were no public hearings on the safety of the facilities.

3. NRC-Type Review Conducted by DOE - A safety review function for the NPR, patterned after the NRC policies and practices, could be conducted within the Department of Energy. The technical reviews and inspections could be carried out by the Assistant Secretary for Environment, Safety and Health acting in a safety assurance oversight function for the Secretary of Energy in the manner that an independent quality assurance oversight function is required to be provided to corporate management in licensed nuclear power plants. The recently created Advisory Committee for Nuclear Facility Safety would provide independent advice to the Secretary on technical safety matters. There could be opportunity for public comment, if the Department chose to provide it. Unlike the NRC situation, the safety of DOE facilities would involve several parties in addition to the licensee and the NRC, namely, the program office, the safety office, the field office, and the facility contractor. There are important choices to be made within this alternative. One is the style of the technical requirements. Presently, the Assistant Secretary for Environment, Safety, and Health is using safety appraisal criteria patterned after the performance criteria of the Institute for Nuclear Power Operations, an industry self help organization. In contrast, the DOE Orders are under revision to be more consistent, to be more compliance oriented, and to provide a higher level of safety. A choice can be made between these alternative styles of regulatory compliance and peer assistance. A second choice that could be made within this alternative is the relative strengths to be accorded the program office and the safety oversight office. The safety oversight office could be granted the right to set safety standards independent of the program office, subject only to the approval of the Secretary. A third choice to be made within this alternative is the relative technical safety capabilities of the program office, the field office, and the contractor. To pattern a safety review after the commercial sector is to assume that there will be balanced, direct, and continuous interaction between a technically strong regulator and a technically strong licensee. In the past the technically strong counterpart of the licensee in the DOE structure has been the contractor, but the safety oversight group has not had direct and continuous contact with the contractor.

4. Establishment of a Defense Nuclear Facilities Safety Board - A likely alternative is that the Congress will establish an independent Board in the Executive Branch to oversee the safety of certain DOE facilities, including the new production reactor. If it comes to pass as currently envisioned in pending legislation, it would involve many of the features of the NRC style of regulation, including

   - input from the NRC and the ACRS;

   - studies and investigations of incidents, operating data, and standards, much like the airline safety oversight functions performed by the National Transportation Safety Board for the Federal Aviation Administration;

- review of new facility designs before construction begins;
- opportunities for public comment and hearings;
- resident inspectors;
- recommendations to the Secretary of Energy with mandatory response times and conflict resolution procedures that end in the Office of the President;
- procedures for imminent or severe threat at operating facilities; and
- annual and special reports to Congress.

The manner in which this Safety Board is conceptualized would provide it with significant authority for the safety of DOE facilities and would serve to assure that the stringent, NRC-type safety policies and practices are implemented for the new production reactor.

3. What is the expected safety assurance process, and what are the desirable NPR technology attributes?

The process options were described in the previous section. Among those, the most likely alternative is the creation of a Defense Nuclear Facilities Safety Board, coupled with further changes within DOE to strengthen the criteria, processes, and technical programs for assuring safety. It is likely that the new process will apply to the new production reactor and will embody a structure and requirements similar in scope and in level of effort to NRC. The question then becomes how should these future changes affect the choice of technology for the new production reactor? The answer is that the technology should, to the extent possible, minimize the uncertainty to costs, schedule, and materials production capability that arises from the need to demonstrate safety in an era of change.

To this end, there are some desirable features of the NPR technology and some related factors, as follows:

- Desirable features of NPR designs to provide safety assurances
  - Technical resilience to determined intervention
  - Proven track record in the NRC licensing process
  - Less susceptible to severe accident uncertainty
- Related factors
  - Technology base including a modern thermal hydraulics calculational capability and operational experience
  - Familiarity with the technology in the technical community
  - Predictability of schedule and resource commitments

The desirable features and related factors are discussed below.

Desirable Features of NPR Designs to Provide Safety Assurances

The previous sections have established that the safety requirements implemented by commercial nuclear power plants are a good indication of what will be required of DOE to demonstrate the safety of the NPR and that the alternative technologies have relative advantages and disadvantages depending on the particular commercial policies and practices that are examined.

This section describes some of the desirable features of the NPR design, in light of what the likely requirements will be and the level of scrutiny to which the safety of the design will be subjected.

Knowing the regulatory process established for the commercial sector, knowing the expectations of the public and the Congress about nuclear safety after TMI and Chernobyl, and knowing what it is reasonable to expect that technology can deliver to fulfill these expectations, the following features of the technology for the new production reactor appear to be of paramount importance:

1. Technical Resilience to Determined Intervention - There will be objection to the NPR, and it is reasonable to expect that the objecting parties will employ the same tactics and technical savvy that have been used for licensed nuclear power plants. Thus, the technical basis for the safety assurances will be tested in detail. The better the technical basis the more likely the test will be withstood without significant increase in cost or delay in operation. There is an extraordinary technological basis for light water reactor safety assurances. It has cost several billion dollars of U.S. government research, in addition to the money invested by private industry. Severe accident phenomena have received nearly a billion dollars of study since TMI by the NRC alone. The technical basis for licensing decisions for the HTGR and LMR have been studied by NRC and DOE for several years, are still being examined by the NRC and DOE, and are generally well understood. The National Academies' report on Savannah River found no comparable technological basis for the heavy water production reactors there, and none has been finalized for the HWR proposed for the NPR.

   In addition to technical resilience to determined intervention, it is important that the technology for the NPR have a high public perception of safety. The four candidate technologies have varying public perceptions. There is a long history of opposition to the LWR by the Union of Concerned Scientists that has shaped public perceptions of LWR safety. Similarly, the Natural Resources Defense Council has been a determined opponent of the LMR technology. There is no known national level of opposition to the HTGR; in fact, intervenor groups have said that the HTGR is a promising concept. There is no history of misperception or intervention for the HWR technology other than the safety concerns that were aired at the time of the National Academies' report in the aftermath of the Chernobyl accident. The DOE record on safety assurances at Savannah River weighs heavily in favor of DOE having prepared for active intervention in any NPR safety review effort. The probability of aggressive intervention may be slightly less for the LWR and LMR than for the HWR, but intervenor groups have a long history of concern over LWR design changes (such as those needed for the LWR candidates for the NPR), non-proliferation concerns resulting from commercial reactors being used in weapons programs, and LMR technologies generally.

2. Proven Track Record in the Licensing Process - All of the available alternative technologies but the heavy water reactor have been tested

by the NRC licensing process and continue to be tested today. There is good assurance that all the technologies except the heavy water reactor technology can withstand the scrutiny of a safety review like that imposed by the NRC. However, despite 25 years of regulatory scrutiny of commercial plants, there is not complete assurance that the LWR candidate for the NPR can withstand modern licensing review without significant delay because of the design changes that will need to be reviewed. Similarly, there is not complete assurance of no delay or change for the HTGR and the LMR because of the fewer number of regulatory reviews of those designs. There is a high likelihood that detailed scrutiny of the heavy water reactor technology will lead to controversy and delay simply because it has never been subjected to detailed safety scrutiny in the public arena and therefore it is untested. The probability that the HWR being proposed for the NPR will be less safe than the LMR and HTGR being considered for use in advanced nuclear power plants also adds to the less predictable outcome for the HWR under careful safety scrutiny.

There is a large body of licensing experience for LWRs. But even with about 120 LWRs licensed, the licensing process and requirements continue to evolve and grow as NRC's safety expectations change. The Electric Power Research Institute (EPRI), in its Advanced LWR Utility Requirements document, lists 900 licensing criteria for design of advanced light water reactors. EPRI is making good use of the last two decades of LWR licensing experience in laying the safety/licensing groundwork for future LWRs. Although this body of experience may appear to put the LWR candidate for the NPR at an advantage, there are two important points to be made which considerably negate that advantage. The first is that LWRs have become very complicated machines and although there is a good experience base, the experience has shown that resources must be very large and considerable time must be allotted for processing an operating license. Indeed, the process has become so cumbersome that the LWR industry's position is that only through standardization and design certification can there be any future LWR power plants. One of the LWR candidates for the NPR (a B&W plant) was well on its way to completion before it was cancelled as a commercial unit. However, as soon as alterations to the design are made, as they must in order to convert it to a production machine and to satisfy potential safety concerns with the Babcock and Wilcox design (no new B&W plant was ever licensed after the accident at TMI), design considerations again come into play. The AEC learned the hard way that last minute modifications need careful scrutiny when it approved a last minute modification to Fermi I (an LMR) that contributed to the subassembly meltdown accident in 1963. Current regulatory practice is structured to assure that this kind of action is not repeated. Second, the other LWR candidate is a contemporary design and not an advanced reactor by NRC standards. This is problematic for the LWR

TABLE 1 - ADVANCED REACTOR REGULATORY EXPERIENCE*
Part A - High Temperature Gas-Cooled Reactors
(The General Atomic Company and its successors were responsible for all HTGR designs.)

Project Identification	Operational and/or Regulatory Experience	Comments and Remarks
Peach Bottom I - 40 MWe, Philadelphia Electric Company, Peach Bottom, PA.	Construction initiated in 1962. OL granted in 1967. Highly successful operation between 1967 and 1974.	First HTGR in U.S. Demonstrated ceramic (graphite) core design and ceramic fuel. Fuel concept differed from later HTGRs as design provided for fission product release and clean-up. Reactor project terminated for economic reasons.
Fort St. Vrain - 330 MWe, Public Service Company of Colorado, Weld County, CO.	Constructed between 1968 and 1974. OL granted in 1974. Operation sporadic, mainly from water ingress from helium circulator bearings.	Provided basis for modern, large HTGR concept through introduction of PCRV, integrated primary coolant system, improved fission product retention in fuel particles through use of silicon carbide layer. Fuel and steam generator performance excellent.
1000 MWe HTGR Study	A 1969 study involving both the staff and ACRS to upgrade HTGR power level. Favorable ACRS letter issued.	LWR type large containment vessel determined to be necessary for a HTGR of this size.
Summit and Fulton plants, sited in Delaware and Pennsylvania, but never built, 700-1000 MWe.	Licensing activities 1973 to 1975. Favorable SERs and ACRS letters issued, but plants cancelled for economic reasons prior to public hearings and CP issuance.	Design based on 1000 MWe study. Substantial component development program planned.

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* Chart reproduced from NUREG-1226, "Development and Utilization of the NRC Policy Statement on the Regulation of Advanced Nuclear Power Plants," by U.S. Nuclear Regulatory Commission.

TABLE 1 - ADVANCED REACTOR REGULATORY EXPERIENCE (Cont'd)
Part A - High Temperature Gas-Cooled Reactors

Project Identification	Operational and/or Regulatory Experience	Comments and Remarks
Gas Cooled Fast Breeder Reactor - GCFR	Concept reviewed by staff and ACRS between 1971 and 1975. Staff concluded that a demonstration plant, subject to the conditions of its SER, could be built.	Some SER concerns about ECCS were later addressed by use of natural convection design for decay heat removal when pressurized.
GASSAR - a standard plant based on Fulton Reactor Design	Staff review initiated 1974, terminated in 1977 with an interim SER.	Detailed review of fission product release from fuel experiments published as NUREG-0111.
Severe Accident Source Term Study - PRA study performed by RES contractors on 2240 MWt concept.	Study performed between 1982 and 1984. Inconclusive quantitative results but valuable insights into HTGR severe accidents developed.	Forms a basic starting point for continued HTGR severe accident analysis. Did not consider air and water ingress events.

TABLE 1 - ADVANCED REACTOR REGULATORY EXPERIENCE (Cont'd)
Part B - Liquid Metal Reactors
(Fast Reactors Unless Otherwise Noted)

Project Identification	Operational and/or Regulatory Experience	Comments and Remarks	Designer
EBR-I (Experimental Breeder Reactor) INEL Site, ID, 1.4 MWt	Plant not reviewed or licensed by NRC. Startup 1951, shutdown 1964.	NaK cooled, first commercial power generation.	Argonne National Laboratory
EBR-II Idaho 62.5 MWt INEL Site (Experimental breeder reactor)	Plant not reviewed or licensed by NRC. Startup 1963, continues in operation.	Has operated successfully for 24 years. Demonstrated inherent safety characteristics of liquid metal reactors and metal fuel.	Principal Nuclear Contractor - Argonne National Laboratory
SRE Sodium Reactor Experiment, Santa Susana, CA, 20 MWt	Startup 1957, shutdown 1964.	Sodium Graphite Reactor (Thermal Reactor)	Atomics International
Hallam Nuclear Power Facility - Hallam, NE, 240 MWe	Startup 1962, shutdown 1964.	Sodium Graphite Reactor (Thermal Reactor).	Atomics International
Fermi-I, Lagoona Beach, MI, 200 MWt	Startup 1963, shutdown 1963.	Experienced fuel melting from partial core flow blockage. Returned to service but shutdown for economic reasons.	Power Reactor Development Corp.
SEFOR (Southwest Experimental Fast Oxide Reactor), Strickler, AK, 20 MWt	Startup1969, shutdown 1972.	Operated successfully until shutdown due to completion of its mission. Demonstrated inherent negative reactivity feedback in oxide fuel.	General Electric
ETEC Facilities - Santa Susana, CA (Non-Nuclear)	Sodium equipment test facility.	Demonstrated liquid metal component performance.	Atomics International

TABLE 1 - ADVANCED REACTOR REGULATORY EXPERIENCE (Cont'd)
Part B - Liquid Metal Reactors
(Fast Reactors Unless Otherwise Noted)

Project Identification	Operational and/or Regulatory Experience	Comments and Remarks	Designer
FFTF (Fast flux test facility), Hanford, WA, 400 MWt	Constructed 1971-1980, NRC performed a safety review of the design and issued an SER (NUREG-0365) in 1978.	Plant has operated successfully for 6 years. Has demonstrated oxide fuel system.	Westinghouse
Clinch River Breeder Reactor - Oak Ridge, TN, 975 MWt	NRC completed the SER (NUREG-0968) and public hearing for CP in 1983.	Plant never built due to lack of funding. Much R&D done in support of design.	Westinghouse

candidates. If there is a commitment to wholesale safety upgrades, as there appears to be, then demonstrating the safety of these upgrades will be a large task.

The licensing experience for the LMR and the HTGR is less extensive. A good summary of the regulatory experience is found on Table 1, which was taken from NUREG-1226, "Development and Utilization of the NRC Policy Statement on the Regulation of Advanced Nuclear Power Plants" (June 1988). In addition to the designs listed on Table 1, the NRC is presently reviewing two LMR concepts and the modular HTGR. The NRC hopes to take an informal "licensability" position on each of these in the near future. Several points are important here. First, both the LMR and the HTGR have been through the licensing process. This in and of itself is an important plus for these two concepts. Second, the HTGR has a major advantage over the LMR in this area of licensing experience--a licensed HTGR is presently operating in the U.S. Not only does this mean that the HTGR is acquiring valuable operating experience, but also the Ft. St. Vrain facility is being upgraded consistent with NRC's latest requirements and safety expectations. This operating experience is an important ingredient in any assessment of safety issues relating to the HTGR.

3. Less Susceptible to Severe Accident Uncertainty - The risk portended by accidents within the design basis for any of the available technologies can be well controlled. Current understanding of safety technology and established licensing practice give high assurance that this is true. It also appears that the largest contributors to remaining risk reside in very low probability events beyond the design basis. It will be required to study that residual risk and either change it or accept it for any of the alternative technologies that are chosen for the NPR. The HWR is very new to the field of severe accident phenomena and the analysis of events beyond the design basis, and there may be more uncertainty about the severe accident behavior for the HWR than for other advanced designs.

   Minimizing the uncertainties that accompany the effects of severe accidents is a prudent action when trying to optimize the choice of technology for the NPR. In such an optimization, it is better to have a risk of "X" with an uncertainty of being five times higher or a factor of five lower, than to have a risk of one-third "X" with an uncertainty of being 100 times higher or a factor of 100 times lower because the public only thinks of the risk being on the high end of the uncertainty range, and the critics of nuclear energy have learned to exploit the upper bound values in a variety of ways. Currently, debates rage over what the update to WASH-1400 (NUREG-1150) is saying, with its uncertainty ranges of three to five orders of magnitude, about the adequacy of current LWR designs. To the extent the choice of technology for the NPR can avoid such debate, it should.

   Uncertainties in the severe accident behavior of a reactor design are of two basic kinds, namely, (1) unknowns in the response of the plant to events beyond the design basis and (2) differences in the potential harm that a particular design can cause. As to the first of these types of uncertainties, the less that is known about a technology, the more uncertainties are going to show up in a related risk assessment. As to the second, the potential for harm is, in turn, a function of the fission product and transuranic inventory (basically a constant when considering the four NPR options) and the potential inherent in the design to release this inventory to the environment, usually via stored energy and fires. The ranking of the four NPR candidates relative to these two parameters is, of course, somewhat subjective, but the trends are clear.

Regarding the "unknown response" parameter, the best candidate is the LWR followed by the HTGR, the LMR and the HWR, in that order. This is not to say that the HWR does not have a technological base; rather it is to say that the small segment of the technical community dedicated to HWR concerns has only very recently started to address the issue of severe accidents in a technical manner. Regarding the "potential for harm" parameter, the LWR has the highest potential with hundreds of millions of BTUs stored in the primary system, hundreds of millions of BTUs stored in the secondary system and hundreds of millions of BTUs potentially released through hydrogen or carbon monoxide fires. Both the LMR and the HWR have considerably less potential because they are low-pressure designs, but the LMR has some unique problems such as a positive sodium-void coefficient of reactivity and the potential for sodium fires. Although the HTGR is a high pressure system, the combination of the single-phase coolant, the low power density and the large margin to failure for the fuel provide a low potential for harm.

On the basis of the consideration of safety assurance factors presented above, it is concluded that there is less risk of delay and unanticipated cost increase associated with chosing the HTGR technology over the other possible technologies for the new production reactor.

Related Factors

Besides the safety assurance factors discussed above, there are some closely related factors that should be considered in making a determination that the risks of demonstrating the safety of the NPR in a cost effective and timely manner are minimized. They are discussed below.

1. Technology base including a modern thermal hydraulics calculational capability and operational experience

   A solid technological base is essential for any nuclear power plant development program and crucial for the assurance of safety for that program. The elements of the safety assurance technology include calculational capability, experimental verification of analyses, and experience. All three are important elements in providing safety assurance. For the LWRs the establishment of a technological base was a long, expensive process. In the area of thermal hydraulics alone, the computer code development work (e.g. RELAP and TRAC) and the experimental programs such as LOFT, PBF and semi-scale, have been massive. This type of capability speaks well for the LWR technology base, although much of it came to be necessary because of the unique thermal-hydraulic properties of LWRs under accident conditions, namely a combination of high pressures, high stored energy, and two phase coolant. The other three technologies have some of these characteristics (the HTGR has high pressure, the HWR has two phase coolant under accident conditions), but none of them have the combination of conditions present in the LWR. And new safety issues are also introduced by the LMR, HWR, and HTGR due to some unique characteristics of their core or coolant, such as sodium fires for the LMRs and high power densities for the HWR. Whatever the safety issue in thermal hydraulics or in any other safety area, it is important that there be a technological base that is commensurate with the magnitude of the issue.

   One area from among all of the technologies where there appears to be a significant lack of technological base is the area of thermal hydraulics for the HWR. Although the HWR does not have a high-pressure, high-energy coolant, the core power density is high, the coolant flow rates are high, and the cooling channels are narrow with convoluted flow paths. These conditions are hard to model, especially since there is so little prototypic data on which to base the modeling. Moreover, it is very expensive and time consuming to experimentally verify the adequacy of such a design. The capability to build electrically heated test sections is doubtful so that the basic thermal hydraulic tests may need to be conducted in a nuclear facility. These problems for the HWR are exacerbated by design changes relative to the Savannah River Plant designs, many of which potentially are safety improvements but all of which will need to be justified by proof testing and analytical verification.

It is difficult to analyze severe accident progressions for any of these candidate facilities, and it will be time consuming, but the problems are worse for the HWR because severe accident modeling is in its infancy and experimental verification and proof testing is virtually non-existent. Larger scale, prototypical testing of some systems may be needed to bring the HWR up to the safety assurance standards that are expected of other reactor systems.

Another measure of a good technological base is experience with the technology in question, including experience in design, construction and operation of similar facilities, national and international support, and an infrastructure dedicated to safety as a first priority.

A ranking of the four NPR candidates according to technology base puts the LWR first followed by the HTGR, the LMR, and the HWR, in that order.

2. Familiarity with the Technology in the Technical Community

Whatever "process" option comes about for demonstrating the safety of the NPR, a broad spectrum of the nuclear safety technical community outside of DOE will be involved in obtaining consensus agreement. Those concerned with the selection of the technology should be aware that anyone given responsibility for detailed assessment or oversight of safety will want to convince themselves that the conclusions they draw are technically sound and defensible. The more familiar the technical community is with the safety issues and the more straightforward the safety problems are for a given technology option, the more likely the process of demonstrating adequate safety can be accomplished on schedule and within budget. Familiarity of the technical community is highest with the LWR and lowest for the HWR. Although not as broad based as the LWR, the understanding of the HTGR and the LMR within the technology community is considerable, both nationally and internationally. There is very little familiarity with the issues and problems of HWR technology outside of DOE and DuPont. Not only will the HWR require more time to educate "outsiders" as individuals, but it also will take more time to reach consensus. For example, it has taken EPRI several years and the assistance of a broad base of experienced people to obtain consensus on the safety design parameters for the advanced light water power reactors. Similarly, the safety design parameters for the advanced HTGR and LMR have been under development for years. The development of HWR safety design parameters is still within the hands of a narrow range of experts and would likely take years to resolve.

3. Predictability of Schedule and Resource Commitments

The resources that will be needed to assure adequate safety of the NPR are large. Further, and perhaps more important to DOE, the time to reach consensus among the appropriate decision makers that the design is safe enough can be sufficient to put the demonstration of adequate safety on the critical path for operation of the NPR. The resources required for safety assurance can be placed in two categories: those of the supplier and those of the safety review organization DOE. If commercial nuclear power plant licensing is any indicator, then the supplier should plan on allocating hundreds of person-years for safety assurance activities alone. Among the supplier's responsibilities will be:

- Preparing preliminary and final safety evaluation reports;
- Preparing an environmental report;
- Performing a PRA;
- Providing reliability assurances including tests, quality assurance, and surveillances for full life cycle; and
- Providing analytical and experimental verification of the design.

Among DOE's responsibilities will be:

- Setting policies and safety objectives;
- Establishing detailed design and construction requirements, e.g., design basis earthquakes, design basis events, general design criteria, PRA guidance, emergency plans, siting guides, reliability guides, criteria for engineered safety features, containment criteria, and human factors;
- Reviewing Safety Analysis Reports, writing Safety Evaluation Reports, and writing Environmental Impact Statements;
- Performing independent analysis;
- Performing independent testing; and
- Inspecting the design.

For NRC to perform its licensing activities, it typically requires tens of person years for design reviews and tens of person years for inspections per light water reactor plant. Setting the standards and developing the guidance also requires NRC to spend on the order of tens of person years per design. The time to process nuclear power plant design reviews does not have to be on the critical path for placing the plant in operation, but it has been the industry's experience that licensing related design changes and changes in the requisite safety assurances can delay operation of a plant for several years. Also, it is very important that a safety review organization have the capability to perform independent testing of safety systems and procedures. If there were such a capability in the U.S. today for

HWRs, the present de-rating of the Savannah River reactors probably would not be necessary.

The resources and time required for safety reviews by DOE probably would not vary significantly among the four NPR technology options, except for the establishment of an independent testing capability, which would be most costly for the HWR. What is more difficult to estimate are the possible delays that could arise from unanticipated issues in the course of the safety assurance process. This is a very real problem and a difficult one to solve once it has occurred. The best choice from a technical point of view is to select the technology which has the least uncertainty in achieving the requisite safety assurances. Here again, experience with operations and testing are important. In the case of commercial LWRs, there have been a number of technical problems that appeared after the safety of the designs was initially reviewed. These included questions about such things as fuel densification, emergency cooling performance, steam generator degradation, and pressure vessel integrity. Such safety problems tend to occur less frequently as a technology matures, but aging itself introduces another set of questions. The point to be emphasized for the NPR is that experience is an important safety assurance parameter, especially when the national security interest can be compromised by either delay or shutdown for protracted technical controversy. The HWR, having the least experience and the least exposure to modern safety concerns, comes out lowest of the alternative technologies in this area.

4. What has been the history of safety assurances for severe accidents?

The importance of addressing severe accidents in providing requisite safety assurances has changed over the last twenty years and has gone hand-in-hand with the development of safety attributes for advanced reactors. With the advent of the large pressurized and boiling water reactors in the late 1960's, severe accidents were considered incredible and, accordingly, were placed outside of the reactor design envelope. The safety system designs were thought to be so good that consideration of design features to mitigate the consequences of severe accidents was unnecessary. Since the accident at Three Mile Island, the situation has become quite different. Issues associated with severe accidents dominate the regulatory agenda and consume large fractions of research and development resources. Advanced reactors are required to consider severe accidents in their design; this has forced a rethinking of the attributes associated with advanced reactors.

LWR Severe Accident History

The designs of commercial nuclear power plants in the United States have been required to accommodate a range of accidents without endangering the health and safety of the public. The events that make up this range of postulated accidents are called design basis events. The worst design basis event generally is the so-called loss of coolant accident, which results in the failure of a number of fuel elements in the reactor but no melting of the fuel. If safety systems work as they are designed, there are no significant offsite consequences from any of the design basis events in commercial nuclear power plants.

For many years, there has been concern with the events that could occur and cause consequences that would be more severe than the design basis events. These were studied extensively in the Reactor Safety Study of 1975 (WASH-1400). That report used the technique of Probabilistic Risk Assessment (PRA) to assess the hazard of potential events beyond the design basis. Although the report showed that the residual hazard of nuclear power plant operation was very small, it was dominated by low probability events beyond the design basis that could lead to very large consequences.

The accident at Three Mile Island (TMI) in March 1979 had several features that were beyond the design basis for licensed nuclear power plants. First, the sequence of events contained more human and equipment failures than is required to be considered in design. Second, the consequences of the accident were more severe in several ways than those for design basis events; namely, there was considerable melting and relocation of the reactor fuel, and there was a large deflagration within the containment from hydrogen that had been generated in the course of the heatup and cooldown of the fuel. The reactor containment structure functioned well throughout the event so that the accidental releases of radioactive material were low and the offsite consequences were insignificant. Overall, the TMI accident called into question the adequacy of NRC requirements for design basis accidents. So, the NRC undertook the development of the TMI Action Plan (NUREG-0660, May 1980), which contained, among a number of other reforms, a planned rulemaking on degraded core cooling to determine whether and to what extent core melt accidents, such as the one at TMI, should be taken into account in the design basis.

After several years of research into the phenomena associated with degraded core cooling, containment response, and other aspects of accidents more severe that the design basis, NRC issued a policy statement on severe accidents on July 30, 1985. The Severe Accident Policy Statement (NUREG-1070) concluded that, with a few exceptions, the safety of operating plants was adequate and that current programs for research, operating experience evaluation, and regulation were adequate to guard against any uncertainty in that conclusion. For future designs, the policy established criteria and requirements including (a) "Completion of a Probabilistic Risk Assessment (PRA) and consideration of severe accident vulnerabilities the PRA exposes.." and (b) conformance to "the Three Mile Island requirements for new plants as reflected in the CP Rule--10 CFR 50.34(f)." An example of a part (f) requirement is that new LWR designs must be able to accommodate hydrogen burns resulting from hydrogen production equivalent to 100% oxidation of all the zirconium metal in the reactor core producing 2,000 to 4,000 pounds of hydrogen for modern LWR facilities. Since this severe accident policy was issued, the NRC has further emphasized the importance it places on these criteria and requirements by restating them in policies on future power plant standardization, on safety goals and on advanced reactors. The accident at Chernobyl gave further weight and focus to the implementation of the Severe Accident Policy for future reactors.

While the Severe Accident Policy was being implemented, PRAs were being completed and major research efforts were in progress, directed to resolving severe accident issues. If there is one phrase to sum up these research and PRA efforts, it is that uncertainties dominate current thinking about the potential consequences of severe accidents involving LWRs, and the uncertainties have delayed final decisions about the acceptability of present safety requirements. This was evident when the radionuclide-source document (NUREG-0956) was criticized by the National Academy of Sciences and when the update to WASH-1400 (NUREG-1150) was published with risk results shown to be highly uncertain, in some cases, by five orders of magnitude.

In this environment, there are major programs in place to resolve severe accident issues. The size of the programs and the lack of success to date in closing issues point to two key characteristics of severe accidents for advanced LWRs. First, severe accident issues are important and second, they are unresolved. In addition to the sizable NRC program in this area, both EPRI (through its Advanced LWR Program) and the Department of Energy (through its Advanced Reactor Severe Accident Program (ARSAP)) are spending large sums of money to resolve issues. At a recent meeting (June 9, 1988) sponsored by NRC, such fundamental questions as "How should acceptable safety be demonstrated regarding severe accidents?", "How should severe accident issues be selected for consideration?", and "What information should be developed to determine if a design is acceptable with respect to severe accidents?" were still being addressed. One lesson to be learned from this is that the safety and reliability attributes for advanced reactors in the NRC's Advanced Reactor Policy must be taken seriously for all future designs, including the NPR. If that is done, then the HTGR and the LMR which have been undergoing review by NRC in accord with that Policy have the advantage of reduced uncertainty of providing the requisite safety assurances in a predictable manner when compared to the HWR and LWR candidates.

HTGR Severe Accident History

Commercial gas cooled reactors were first developed during the early 1950's in Great Britain and France. A severe accident occurred in one of the early U.K. reactors at Windscale in 1957. It was the source of numerous safety lessons for later gas-cooled reactors, including the HTGR. In the late 1950's, the high temperature aspect of gas reactors, the use of helium for cooling, and the design of the fully ceramic core were developed in the United States. This effort resulted in the 40 MWe Peach Bottom-1 HTGR, operated between 1967 and 1974, and the 330 MWe Ft. St. Vrain HTGR which was licensed to operate by the AEC in 1973 and continues to operate. The AEC and NRC reviewed these plants using methodologies similar to those used for light water reactors. Certain design basis accidents were identified and analyzed on a deterministic basis. The level of safety in the design of Ft. St. Vrain has been determined by the NRC to be such that no conventional containment structure is necessary and reduced emergency planning measures are required.

The first probabilistic risk assessment (PRA) of an HTGR was the Accident Initiation and Progression Analysis (AIPA) funded by the Energy Research and Development Administration (ERDA) in the mid 1970's for a large, commercial HTGR (3000 MWt). Initial review was performed by several outside parties including the NRC. Phase II of the AIPA was issued in 1978 and examined additional severe accident issues such as concrete degradation, combustible gas generation and containment response. Independent West German reviews of the AIPA study have been performed in association with the German HTGR program. HTGR models and data have been exchanged and studies cross-reviewed with the Germans. Indeed, there is an active professional community engaged in HTGR safety work that enjoys a world wide base.

In the early 1980's, the NRC conducted a study to examine core heatup events with fuel failure for the proposed 2240 MWt HTGR power plant. Both the frequencies and consequences for HTGR severe accidents were reviewed. More recently, a PRA was performed for the DOE Modular HTGR (the advanced commercial reactor). Due to the goal of exemption from emergency planning the results assume a worst case individual remains at the 425 meter exclusion area boundary for the duration of any event. Earthquakes were included as a representative external event. Peer review was conducted within the DOE program and by others prior to submission to the NRC. The results of this PRA help establish the design safety of the HTGR and are well within NRC's safety goals for nuclear power plants. NRC review of this PRA is presently ongoing.

The NRC Advanced Reactors and Generic Issues Branch has sponsored research in preparation of a Safety Evaluation Report for the advanced Modular HTGR. Evaluation of accident scenarios by Oak Ridge National Laboratory and Brookhaven National Laboratory have revealed no accidents in which fuel failure is postulated to occur. The research performed in the analysis of severe accidents for HTGRs indicates that these designs have many desirable inherent safety features. Their technological basis for safety lies not in active systems to maintain core cooling and coolant inventory, as in water cooled reactors, but in the ease of cooling the silicon coated fuel particles. To preserve this inherent safety characteristic, it is necessary to meet tight fabrication specifications. This is a manufacturing and quality control exercise, the success of which is determinable prior to loading the fuel. Experience with this same type of fuel at the Ft. St. Vrain reactor indicates that the design specifications for the fuel can be met.

LMR Severe Accident History

In 1966, the Fermi I LMR experienced some fuel melting as a result of partial blockage of a subassembly coolant channel. The lessons learned from this incident were important in removing severe accident initiators in the design of future LMRs.

Although there was an early interest in severe accidents for LMRs, the analysis of those accidents did not progress very far before the start of the safety review of the Fast Flux Test Facility (FFTF) and the licensing review of the Clinch River Breeder Reactor (CRBR). In a letter of May 6, 1976, the NRC staff informed the CRBR Project Office of NRC's position on core disruption accidents (severe accidents). Basically, the letter said that core disruption accidents would not be considered as part of the design basis for CRBR, but they would be used as the basis for additional measures to be taken to limit consequences and reduce residual risk to ensure that the public health and safety was adequately protected. The research in LMR severe accidents during this period was oriented to better understanding the phenomena and devise ways to mitigate the effects of severe accidents. The NRC report, "An Analysis and Evaluation of the Clinch River Breeder Reactor Core Disruptive Accident Energetics," NUREG-0122, published in March 1977, was typical of studies during that time. One of the severe accident issues discussed in that report that continues to this day for the LMR is the relatively large positive sodium void coefficient of reactivity. Although the CRBR mixed-oxide fuel design is quite different than the present metal-fuel LMR design and the LMR designers have reduced the probability of sodium voiding considerably, that troublesome characteristic still is intrinsic to the design.

With the exception of the positive sodium void coefficient issue, LMR designers have solved many of the safety problems associated with severe accidents. Proof testing under bounding accident conditions at the EBR-II facility has contributed to the understanding of severe accidents. Added to this is PRA experience from the CRBR, from the Large-Scale Prototype Breeder project sponsored by DOE and EPRI, and from the more recent LMR design efforts--the Sodium Advanced Fast Reactor (SAFR) and the PRISM design by General Electric.

HWR Severe Accident History

DuPont has embarked on a major Probabilistic Risk Assessment program for the Savannah River heavy water reactor facility. This full-scope PRA is over 50% completed and, when finished in 1989, should provide a large body of information regarding the probability and consequences of severe accidents for that type of plant. This would provide a good starting point for extrapolation of the severe accident results to the HWR design candidate for the NPR.

The only other country to make significant use of heavy water technology is Canada in its unique pressure tube CANDU reactor. There has been no significant relationship between the U.S. and the Canadian HWR programs.

5. What are the possible solutions to any problems expected in providing adequate safety assurances for the NPR?

The process for assuring safety for the NPR will be complex and controversial. It is important for the DOE decision-makers to be aware of the difficulties that will arise in demonstrating adequate safety and to give consideration to ways to minimize them. This report has attempted to do that by describing the key elements that make up safety assurance today and by comparing the four candidate technologies against these key elements. From a regulatory, safety-assurance perspective, the candidate that looks most promising in minimizing these problems is the HTGR.

The key elements that make up safety assurance are:

- The ***process*** of demonstrating adequate safety based on NRC policy and practice;
- The ***public and Congress*** as major contributors in establishing safety assurance;

- The role of ***severe accidents*** in determining adequate safety; and
- The importance of the advanced reactor attributes--***simplicity and inherent safety***--in providing adequate safety assurance.

These elements, taken together, constitute a significant new era in demonstrating safety for nuclear plants in the United States, especially for the NPR, which the DOE is determined to make at least as safe as modern commercial LWRs. Safety assurance today is substantially different from what it was a decade or even five years ago. Further, safety assurance has been markedly different in the commercial sector than in the defense sector. But DOE recently has set in motion an extensive program to upgrade safety assurance in the defense sector, bringing it more in line with that of the commercial sector.

When tested against these elements of the new era of safety assurance, the HWR has the most difficult problems ahead in assuring safety. Although significant problems exist for the LMR and for the LWR, they do not appear to be as problematic as the HWR. Finally, although problems also exist for the HTGR, it is the best choice from the safety assurance perspective provided in this report.

The Heavy Water Reactor

The HWR technology is only now, in 1988, beginning to employ modern regulatory and safety assurance practices. In virtually very aspect of the safety assurance process, the HWR has been shown to be seriously lacking. It has never participated in regulatory reviews, reviews that DOE will be insisting on for all of its hazardous facilities. To conform to a modern process will be a major undertaking. As revealed in the recent safety study of the Savannah River reactors by the National Academies, the HWR concept does not have the technological base to demonstrate safety. Codes, proof testing, and experimental data are lacking. And the design changes in going from the Savannah River design to the NPR design further complicate the situation.

The public and the Congress will consider the HWR an unknown quantity. Their only acquaintance with the HWR is through the Savannah River Plant, which is a problem in its own right. The public and Congress have perceptions of safety that do not always coincide with the realities of safety. Perceived problems, which may not be real, are often correlated with unknowns or uncertainties in safety assessment, but it is the perceived problems that will drive the decision process.

HWR severe accident technology has not kept pace with the rising importance of severe accidents as an ingredient in safety assurance. Only recently have PRAs been undertaken for the HWRs at Savannah River. Severe accident research that addresses the core melt phenomena for the HWR is in its infancy.

While the HWR proponents claim that the HWR has certain safety attributes proposed by the NRC in the Advanced Reactor Policy Statement, the approach to inherent safety and simplicity is only piecemeal. Also, the passive cooling capability claimed for the new HWR designs has not been analyzed or tested.

The Liquid Metal Reactor

The LMR has an advantage over the HWR in the area of safety assurance process. Although the Clinch River Breeder Reactor (CRBR) was a different design than would be used for the NPR, there would be benefit from the CRBR licensing experience which included the completion of a Safety Evaluation Report and a construction permit hearing prior to cancellation of the project. More importantly, the commercial version of the LMR is pending before the NRC for a licensability review. However, there is no licensed LMR in the United States. Further, the CRBR review was not conducted against modern safety assurance standards, and operating experience that would be helpful for the LMR is limited.

As with the HWR, the LMR is not well known in Congress or among the American people. Thus, there is the risk that the LMR will be at the same disadvantage as the HWR; namely, in the public's eye, unknowns are equated with perceived risk. Further, the LMR has a relatively large positive sodium void coefficient, about the same size as the coolant void coefficient at Chernobyl. To dismiss the implications of this design characteristic on probabilistic grounds, even if sound technically, is difficult. Although LMR research in severe accidents is continuing, many of the severe accident issues have been resolved for the LMR.

The advanced LMR designs proposed for power plants have advantages over the HWR in inherent safety and in simplicity of operation. They also conform to the spirit of the NRC's advanced reactor policy statement.

The Light Water Reactor

The LWR has far more experience in the licensing and safety assurance process than the other three technologies. Also, the LWR operations experience is vast. But three important problems should be pointed out. First, both of the LWR candidates, the Westinghouse upgrade of its 4-loop design and the WNP-1 B&W unit, are old by advanced light water reactor standards. Second, the advanced light water safety standards are in a state of flux. Third, the NPR version of either the Westinghouse or the B&W-designed reactors will require redesign of the NSSS. Thorough evaluation of their safety would be warranted.

The LWR is not an unknown with the public or Congress. This is both an asset, in the sense that they have been educated regarding the LWR, and a liability, in the sense that they are aware of the accident at TMI, the B&W incidents at Davis Besse and Rancho Seco, and other LWR safety problems that have been visible over the past twenty years. The UCS and other intervenors have been vocal in their opposition to LWRs over the years and can be expected to raise many of the unresolved issues again.

The uncertainties related to severe accidents for the LWR are still large and continue to frustrate the resolution of major issues. For example "direct containment heating" is a major uncertainty which when resolved may mean backfits for some pressurized water reactors. The LWR is at a distinct disadvantage relative to the other three candidates since it is such a complicated machine with a potential for release of radionuclides not shared with the other three candidates.

The light water reactor requires active systems to assure safety. The motivation for the NRC's Advanced Reactor Safety Policy Statement was in large measure due to the problems with LWRs.

The High Temperature Gas-Cooled Reactor

The HTGR, compared to the other candidates, is in an advantageous position for demonstrating safety. It has up-to-date regulatory and operating experience at Ft. St. Vrain that cannot be matched by the HWR or the LMR. Further the commercial version of the modular HTGR is the lead advanced reactor under safety review consideration by the NRC. It leads the LMR in that regard, while the HWR and the LWR are not even competing.

The HTGR has a unique spot in relations with Congress and the general public. First it is a well known concept in Congress. In fact its year-by-year support comes from Congress. Further, the HTGR has been well received by groups that are traditionally hostile to nuclear power. This suggests that support outside of the technical establishment may be strong.

The HTGR risks from severe accidents have been known to be low for a long time. The fact that Ft. St. Vrain has no containment--the only licensed facility in the country without one--is evidence of this. Although there are some unresolved issues with the

NRC, the NRC staff believes the problems can be resolved; in July 1988, the NRC staff concluded that the commercial version of the HTGR will need no evacuation plan.

Simplicity and inherent safety are important attributes of the HTGR. No active systems are needed for shutdown and heat removal for weeks after an accident within the design basis.

Concluding Remarks

It is the conclusion of this report that, from a safety assurance perspective, the HTGR is the reactor of choice for the NPR. Stepping back from that perspective and considering some broader issues that affect safety of nuclear power in general, several further points are appropriate, all of which further support choosing the HTGR technology for the next NPR.

- The federal budget for nuclear technology, apart from the production of nuclear defense materials, has been relatively constant for several years, and all safety research has come out of that budget, whether it is for commercial power or for DOE and military applications. If the decision is made to go with the HWR, it will require large safety expenditures for a technology unique to the NPR, thus diverting needed funds from other important safety research programs. It could detract from reactor safety research applicable to the commercial sector.

- Both the commercial and the military applications sectors could benefit considerably from a shared safety technology. Safety information developed for the commercial reactors could be of use by the NPR and vice versa. The advantages of sharing safety technology cannot be over estimated. This could not happen if the HWR was chosen as the NPR.

- It has been said that choosing a technology other than the HWR would compromise the distinction between nuclear reactors for weapons production and nuclear reactors for power production. This argument may have some merit for one of the LWR candidates for the NPR because that candidate is a pressurized water reactor that was initially designed and built for commercial applications. However, it is worth noting that the pressurized water reactor technology now used around the world evolved from the U.S. Navy's nuclear propulsion technology.

- Finally, DOE, through its NPR program could make a significant contribution to the future energy security of the United States by choosing a reactor type that has potential to meet future energy needs in a safe and environmentally acceptable way. In this way, the Department also will serve to limit the number of nuclear reactor designs in the United States. This is a problem of safety significance that has plagued the country for a generation and that the Energy Research Advisory Board has urged the Department to solve.

APPENDIX A

CREDENTIALS OF AUTHORS

Dr. James F. Meyer has a background in reactor safety and licensing that spans more than 20 years. He is an authority in the field of severe accident behavior (core melt accidents) of nuclear plants. After 5 years at Argonne National Laboratory where he performed reactor physics experiments, he joined the Nuclear Regulatory Commission where he spent more than 10 years dealing with severe accident analysis and other safety issues. Among the projects that he worked on were the Clinch River Breeder Reactor, the Fast Flux Test Reactor, the Zion and Indiana Point pressurized water reactors, and the Limerick power station. He also performed safety and "licensability" studies for candidate designs that were part of President Carter's non-proliferation program. He has policy level experience with severe accident and advanced reactor issues as the technical assistant to a Commissioner of the NRC from 1983 to 1987. Since leaving the NRC, Dr. Meyer has served as a consultant on severe accident safety issues.

Dr. Roger J. Mattson has more than 20 years of experience in nuclear reactor safety, most of which were spent at the Nuclear Regulatory Commission from 1967 to 1984. For seven of those years at NRC he directed most of the technical review of all licensed nuclear plants in the United States. He was a principal contributor to the NRC's Action Plan issued in 1980 after the accident at Three Mile Island, the NRC's Severe Accident Policy Statement issued in 1985, and the Safety Principles issued in 1988 by the International Nuclear Safety Advisory Group of the International Atomic Energy Agency. Among other assignments since leaving the NRC, Dr. Mattson has participated in design reviews of the production reactors at Hanford and Savannah River, served on the UNC/NI Corporate Nuclear Review Board for N Reactor, served on the Nuclear Review Board for Philadelphia Electric Company, and assisted the NRC in the interpretation of the accident sequence at the Chernobyl reactor in the Soviet Union.

[From The Energy Daily, Washington, DC, Monday, July 25, 1988]

HTGR BACKED FOR WEAPONS REACTOR

From a safety point of view, the Department of Energy should pick the High Temperature Gas Cooled Reactor when it selects the technology for its new weapons production reactor, according to a report by two veteran nuclear scientists scheduled for release this week. DOE is expected to make a multibillion dollar decision shortly on what kind of reactor to buy to produce tritium, a key ingredient in nuclear bombs. Four different reactor technologies are competing for the contract.

"When the alternative technologies are viewed from the perspective of providing the highest probability of demonstrating adequate safety in a timely and broadly acceptable fashion, the High Temperature Gas Cooled Reactor has significant advantages over the Light Water Reactor, the Liquid Metal Reactor and the Heavy Water Reactor," write Roger Mattson and James Meyer in the new study. "It has a better technical basis for responding to determined intervention, it has a proven track record in the NRC licensing process and it has lower severe accident risk. The HWR presents the highest risk because of the lack of regulatory background and the uncertainties surrounding severe accidents."

Mattson and Meyer are former NRC officials with extensive experience in nuclear reactor safety. Their study was commissioned by the National Defense Council Foundation, a 10-year-old Washington group that describes its purpose as being "in defense of free enterprise, country and Constitution."

If DOE decides to go with an HWR for its new tritium plant, the report says, large safety expenditures will be required for a technology unique to the new production reactor, thus diverting needed funds from other important safety research programs. It could detract from reactor safety research applicable to the commercial sector.

"DOE, through its new production reactor program, could make a significant contribution to the future energy security of the United States by choosing a reactor type that has potential to meet future energy needs in a safe and environmentally acceptable way," the scientists write. "In this way, DOE also will serve to limit the number of nuclear reactor designs in the United States."

USE OF CIVILIAN POWER REACTOR FOR MATERIAL PRODUCTION

Senator HATFIELD. Mr. Chairman.

Senator JOHNSTON. Senator Hatfield.

Senator HATFIELD. Mr. Chairman, I am being solicited to the floor to help co-manage the appropriation bill on Labor-HHS in the absence of Senator Weicker. So I will not be able to remain, but I would like to have two questions submitted for the record.

Most particularly, my concern about fuzzing over the clear line of delineation between civilian and military uses of atomic or nuclear materials that we have maintained over the years and the implications of relating to proliferation of nuclear power in the world. I am deeply concerned about the talk of taking a $2 billion plant that has been chartered or licensed for a civilian plant in my part of the country, in the Northwest, and moving that into weapons production. I think it would be a legitimate question to be considered if one of the developing countries of the world did this.

I am deeply troubled by the whole implication of these points and they are stated in my questions which I would like to have submitted for the record.

Senator JOHNSTON. Those questions will be included at the appropriate place in the record.

Senator HOLLINGS. Will the distinguished Senator yield?

I have the same feeling relative to developing a commercial reactor into a defense facility, and a similar feeling that the Senator has that we don't take a defense reactor and start building it for commercial use. Because, that is the main point of our distinguished colleague from Idaho.

Senator HATFIELD. I would have the same trouble as long as it is proliferating nuclear power.

Senator MCCLURE. That is not the main point of the Senator from Idaho. That is one part of the discussion.

The main part I am concerned about is security for this country and having an adequate NPR that is functional and it is assured functional capacity at all stages in the future. I don't care how that is accomplished. I don't have any preconceptions about how that is accomplished, but, Senator, you know the dangers that occur if, as a matter of fact, all four of the reactors at the Savannah River had had the same design as the C Reactor. They would all four be shut down today. This government today would have had no choice except to continue to operate the N Reactor at Hanford. We would have no tritium production facilities at all.

Senator JOHNSTON. Senator Domenici, do you have any comments?

Senator DOMENICI. I have none yet.

Senator JOHNSTON. Mr. Salgado, welcome; please proceed.

STATEMENT OF JOSEPH F. SALGADO, ACTING DEPUTY SECRETARY OF ENERGY, DEPARTMENT OF ENERGY

Mr. SALGADO. Thank you, Mr. Chairman.

I would like first to take the opportunity to introduce first, to my left, Mr. Del Bunch, who is the Principal Deputy for Nuclear Energy. Mr. Wade has already been introduced; to his far right is Mr. Ron Cochran, the Principal Deputy for Major Projects within the Defense Programs arena.

I would ask, Mr. Chairman, that my prepared statement be included in the record.

MISSION OF DOE

As we are all aware, the mission of the Department of Energy is to produce special nuclear materials to meet defense requirements. The future requirements of this country cannot be met reliably with existing facilities. The Department's long-range plans for production of nuclear materials involves the replacement of our existing production reactor capacity in a manner to assure reliable production of tritium and plutonium in quantities that will satisfy future defense needs.

NEW PRODUCTION REACTOR CAPACITY

The need for new production reactor capacity is driven by the need for an assured supply of tritium for our nuclear weapons. You are all aware that the tritium has to be replaced in our nuclear stockpile because it decays at a rate of approximately 5 percent per year.

I would like to go back to the past, if I could, for a second. The past is not remote. In 1985, this country had five reactors in the defense facilities, operating and producing special nuclear materials. Five reactors—one at Hanford, four at Savannah River. Today, as we sit here, this country has the capacity or the capability to put one and one-half reactors on line. In those 3½ years, this country has lost three and one-half reactors in capacity.

What happened? Obviously, in May 1986, the Chernobyl incident occurred and numerous reviews and safety inspections were undertaken both at Savannah River and the Hanford facility. As alluded to earlier, the C Reactor, because of embrittlement and cracking in the vessel, could not be repaired and was brought down. The other remaining three reactors at Savannah River, after a review by the National Academy of Sciences and the National Academy of Engineering, as requested by the Secretary, had their power levels reduced to 50 percent.

A review of the N Reactor at the Hanford facility indicated that upgrades in safety needed to occur. Those were undertaken and as missions changed and the defense requirements for plutonium changed in the outyears, it was determined not to bring the N Reactor back on line.

The key issue of the National Academy of Sciences in its overall review of our class A reactors came to a very disturbing and a very troubling conclusion. They concluded that the production reactors all display symptoms of acute aging and the remaining useful lives are likely to be equal to or shorter than the time needed to build new production facilities. If the United States finds it necessary to have a reliable and safe production capability, then the planning and construction of a new production reactor capacity should be accelerated, and that is why we are here today.

REVIEW PROCESS

The Secretary, upon that review and upon the existence of our reactors in their 50-percent mode of operation, brought together a long-term plan or a strategy for developing the technology selection or selections for new production reactor capacity. We brought together two modes. We brought together the Energy Research Advisory Board, under Mr. Schoettler, and we also brought together a Site Evaluation Task Force internally within the Department of Energy, both on parallel tracks.

ERAB was to do an analysis of the ongoing technologies that could be utilized for a new production reactor into the next century, and the Site Evaluation Task Force to do an ongoing analysis of a site that would be available to the Department for a new production reactor or reactors, if it was so determined by the Department of Energy and by Congress.

We specifically asked ERAB also to include an assessment of duality; that is, diversity of technology and the use of more than one site. I need not report the findings of the report, they have been alluded to here and that report is a public document.

REACTOR TECHNOLOGIES

For the record, I should indicate that the four technologies that we are looking at are: the heavy water reactor, the high-temperature gas-cooled reactor, the light water reactor, and the liquid metal reactor technology. That process has been completed and ERAB has completed its job. The Site Evaluation Task Force has completed its job. As outlined in letters to Congress and mandated by Congress, we have advised Congress of the process that was undertaken within the Department of Energy, both to analyze the ERAB recommendation and to analyze the Site Evaluation Task Force recommendation.

We have committed to Congress to have an open dialogue with other components within the executive branch that have a vested interest in the new production reactor and special nuclear materials capacity. We have had consultation with the Nuclear Weapons Council, with the Department of Defense, with the National Security Council, and with the Office of Science and Technology of the President. We have had consultations also with OMB and, obviously, we have had consultations, gentlemen, with Members on the Hill in various forms and various capacities.

PROGRAM RECOMMENDATIONS

The process is now coming to conclusion and this opportunity here today with this committee avails us of more input and more information upon which the Secretary can base his decision. Within the week, we expect that Mr. Wade will present before ESAAB within the Department of Energy not only the program recommendation, but the result of consultation from those external bodies as well as consultations with Members of Congress. The decision process will go forward to the Secretary for a decision.

We must look at what the future of this country and the future of the nuclear weapons needs look like in the year 2010. I think it is our obligation with the executive branch, working with the legislative branch, to ensure that this country has the capability to meet and the capacity to meet future demands in our national security defense role.

I thank you, Mr. Chairman, and I welcome your questions.

Senator JOHNSTON. Thank you very much, Mr. Salgado.

[The statement follows:]

STATEMENT OF JOSEPH F. SALGADO

Mr. Chairman and Members of the Committee, I am Joseph Salgado, Acting Deputy Secretary of the U. S. Department of Energy (DOE). I am here to provide testimony regarding the Department's acquisition strategy for new production reactor capacity.

The mission of the Department of Energy's Nuclear Materials Production program is to provide nuclear materials to meet defense requirements. Future requirements cannot be met reliably with existing facilities. The Department's long-range plans for the production of nuclear materials involve the replacement of our existing production reactor capacity in a manner to assure reliable production of tritium and plutonium in quantities that will satisfy future defense needs.

The need for new production reactor capacity is driven by the need for assured supplies of tritium for our nuclear weapons. Without a continued supply of new tritium, the effectiveness of our overall nuclear deterrent capability deteriorates rapidly. Tritium is required for both new weapons and for replenishment of the stockpile, since approximately 5 percent of the total tritium inventory is lost each year through natural radioactive decay (12.3 year half-life). Due to this high rate of radioactive decay, tritium must be provided to the stockpile on a continuous basis. Nuclear reactors are the only proven, practical means for producing tritium.

Currently, three production reactors, located on the Savannah River Plant (SRP) site in South Carolina, produce nuclear materials for the Nation's defense requirements. These reactors were commissioned in 1954 and have experienced aging effects that have reduced their operational reliability. A fourth reactor at the SRP site, the C Reactor, was retired from service in January

1987 for causes related to aging. Additionally, the N Reactor, located at Richland (Hanford), Washington, was operated between 1964 and 1986, primarily for plutonium production. The N Reactor was shut down in January 1987 for safety upgrades and modifications, some of which are still underway. In February 1988, a decision was made to place N Reactor on cold standby.

In order to determine additional actions that should be taken, Secretary Herrington requested the National Academy of Sciences and the National Academy of Engineering (NAS/NAE) to study and report on the aging effects and safety concerns at the SRP reactors. The NAS/NAE report raised issues concerning the adequacy of emergency core cooling systems at SRP reactors. In response, DOE reduced the power levels at the SRP reactors in March 1987 to 50 percent of their normal operating levels until the necessary analyses and modifications are completed to support safe increases in operating power levels. If we encounter any additional problems at these reactors, our production capacity for tritium will be severely reduced and our need for new production capacity will become even more urgent.

In its report on "Safety Issues at the Defense Production Reactors," the NAS/NAE concluded, among other things, that the production reactors all display symptoms of acute aging and their remaining useful lives are likely to be equal to or shorter than the time needed to build new production facilities; and if the United States finds it necessary to have a reliable and safe production capability, then planning for new production reactor capacity should be accelerated.

Based on Administration concerns that new production capacity is needed, together with the NAS/NAE findings, the Secretary established a process dedicated to ensuring an objective and thorough analysis of the issues concerning the acquisition process for new production reactor capacity. The Secretary commissioned two evaluations, one on new production reactor technology and one on sites. This allowed the Secretary to assemble nationally known experts to evaluate the large amounts of data available on technology and provide DOE with the best information available on which to base a decision. This process also provided for thorough consideration of a diversity of views.

To assist in the technology evaluation process, Secretary Herrington asked the Energy Research Advisory Board (ERAB), one of his standing advisory committees to conduct a review and assessment of four nuclear reactor technologies being considered by the Department as candidates for the new production reactor capacity. On January 7, 1988, the Secretary requested that ERAB review and assess: the DOE proposed selection criteria; the adequacy of each technology to meet the criteria; and the schedule, technical risks, benefits, and costs in implementing a production reactor program with each technology. The ERAB also was requested to include an assessment of duality, i.e., diversity of technologies and use of more than one site.

The reactor technologies considered in the ERAB evaluation process were: (1) Heavy Water Reactor; (2) High-Temperature, Gas-Cooled Reactor; (3) Light Water Reactor; and (4) Liquid Metal Reactor. These candidate technologies were chosen on the basis of their high potential to meet production requirements.

The ERAB panel of 19 experts included individuals with extensive experience in the management of reactor facilities, nuclear engineering, engineering of large energy systems, safety and environmental concerns, and physics. The panel used six additional technical experts to help evaluate the large amount of technical information that was presented by proponents for each of the reactor types. The Panel was divided into four subpanels, each concentrating on one of the four technologies.

The ERAB panel has completed the technology evaluation and submitted its report to DOE. The evaluation provides a sound, independent review that will permit DOE to continue its decision process.

To assist in the site evaluation process, a Site Evaluation Team (SET) composed of key DOE staff was established on January 28, 1988, and was charged with developing evaluation criteria and evaluating candidate DOE sites for new production reactor capacity. The three candidate DOE sites were: (1) the Hanford Site, Richland, Washington; (2) the Idaho National Engineering Laboratory, Idaho Falls, Idaho; and (3) the Savannah River Plant, Aiken, South Carolina. The SET used the following criteria for evaluating these sites: experience base; site support facilities; environment, safety and health; transportation; cost and schedule; safeguards and security; utilities; and socio-economic factors.

In conducting the evaluation process, members of the team visited each site to receive a briefing on the site's capability to accommodate new production reactor capability. They also toured the support facilities and proposed sites.

The site evaluation team has completed the evaluation of candidate sites and submitted its report. The SET makes no recommendations as to siting an NPR. The report is intended as one of several inputs to permit DOE management to continue the decision process. The Department also is addressing the merits of the use of a second deployment site. A fundamental means for guaranteeing reliability in supply of tritium is to avoid dependence on a single reactor. Multiple reactors also would provide some level of redundancy, although not necessarily 100 percent redundancy. The desired degree of redundancy would depend on strategic considerations, the technology of the reactor(s), fiscal constraints, and other factors.

The DOE decision process has also included consultations with several governmental agencies to obtain their views and recommendations regarding the acquisition strategy for replacement reactor production capacity. These consultations are taking place with representatives from the Department of Defense, the Office of Science and Technology Policy, the National Security Council, the Nuclear Weapons Council, and the Office of Management and Budget. The principal topics of concern are the requirements for assured supplies of tritium and plutonium and the concept of duality, including deployment of diverse technologies at more than one site.

The DOE evaluation approach is to consider fully the results of all consultations. The acquisition strategy is consistent with the objectives and particular interests of each agency with respect to requirements for tritium and plutonium and production assurance. The consensus is that the achievement of production assurance on an urgent schedule and in a safe and environmentally sound manner are the key elements in the acquisition strategy.

The Secretary has directed the Energy Systems Acquisition Advisory Board (ESAAB) to evaluate the information provided by the Energy Research Advisory Board and the DOE Site Evaluation Team. The Department's ESAAB is an internal Assistant Secretary level corporate review group established to secure an objective analysis and evaluation of all relevant data. The ESAAB has met several times in this month (July 1988) to review information related to the designation of preferred technology(ies) and site(s) for new production reactor capacity. At these meetings, the findings of ERAB and the Site Evaluation Team were reviewed, and Defense Programs provided specific comments regarding the candidate technologies and sites. The ESAAB is currently assessing and evaluating all relevant data provided to date. The evaluations are expected to be completed and presented to the Secretary later this month (July 1988).

The Department submitted two status reports to the Congress on the acquisition strategy, one on February 25, 1988 and the other on May 10, 1988.

The Department's final report is scheduled to be submitted to the Committees on Appropriations and Armed Services of the Senate and the House of Representatives in early August. The report will describe the strategy for acquiring new reactor capacity for production of nuclear materials including evaluations of alternate technologies and sites, associated costs and schedules, and the Secretary's recommendations.

That concludes my prepared remarks and I would be pleased to respond to questions.

STATEMENT OF JOHN H. SCHOETTLER, CHAIRMAN, ENERGY RESEARCH ADVISORY BOARD

Senator JOHNSTON. Next we would like to call on Mr. Schoettler, who is Chairman of the ERAB.

Do you have to leave, Mr. Salgado?

Mr. SALGADO. I thought we were going to go in sequential order, but whatever is the chairman's prerogative.

Senator JOHNSTON. I think, if you have time, it would be better to go ahead and hear from all the panel members and then have questioning of each one, because we don't really have enough time this morning to take each witness one by one.

Mr. SCHOETTLER. Good morning, Mr. Chairman.

I am John Schoettler. Much of the testimony that you have already heard or that has been read by Deputy Secretary Salgado would be repetitive if I went through all of mine. I would ask that the transcript of my testimony be included in the record this morning.

The Energy Research Advisory Board was asked in January by the Secretary of Energy, John Herrington, to review and assess the Department's proposed selection criteria for the NPR, the adequacy of each of the four technologies to meet that criteria, and schedule and technical risks, benefits, and costs in implementing an NPR program with each technology. We were asked to report back to the Secretary by June 1, and we received an extension until July 1.

During this period of time, we submitted an interim report looking at the criteria, raising safety and environment to parity with reaching goal quantities of tritium and we also got clarification on the duality issue, which you have already discussed and which Deputy Secretary Salgado covered.

We formed a panel of 19 experts, individuals with wide experience in the management of reactor facilities, nuclear engineering, engineering of large energy systems, safety and environmental concerns, and physics. The panel was burdened by the presence of a geologist who happened to be Chairman of the Energy Reserch Advisory Board.

We divided that panel into four subpanels, each concentrating on one of the four technologies. This seemed to be the most expeditious way of getting through it in the time that was allotted to us.

I would like to point out that the ERAB was not requested to make recommendations in this report and did not rank nor directly compare the four technologies. We were not asked to do so. Rather we assessed each of the four technologies according to the criteria and considered risks and benefits. The report presents 14 findings and a table of strengths and weaknesses of each technology when used for an NPR.

The primary thrust of the charge letter from Secretary Herrington to the Energy Research Advisory Board was that the purpose of the NPR was to produce goal quantities of tritium. The schedule and cost data that was presented to the Energy Research Advisory Board and its panel was judged to be preliminary and useful only for qualitative comparisons. The information was prepared originally for other purposes and on a different basis in each case.

In regard to schedule and cost, the report notes that successful development, design, construction, and startup of an NPR requires a continued commitment from both the executive branch and the Congress over many years.

I have rather briefly summarized some of the issues that I feel are important to decisions on the NPR and I would be happy to try and answer questions on these or any other aspects of the ERAB NPR report, Mr. Chairman.

Senator JOHNSTON. Thank you very much, Mr. Schoettler.

[The statement follows:]

STATEMENT OF JOHN H. SCHOETTLER

Good Morning. I am John Schoettler, Chairman of the Department of Energy's Energy Research Advisory Board (ERAB). The Board advises the Secretary of Energy in response to specific requests from the Secretary and conducts itself in accordance with the requirements of the Federal Advisory Committee Act. I am pleased to be here today to discuss the recent assessment done by the ERAB of four reactor technologies that are candidates for new production reactor (NPR) capacity.

The Board was asked by the Secretary, in a letter to me on January 7, 1988, to review and assess the Department's proposed selection criteria for the NPR; the adequacy of each of the four technologies to meet the criteria; and schedule and technical risks, benefits and costs in implementing a NPR program with each technology. The letter requested a response by June 1, 1988, but the Secretary later agreed to a one-month extension of the response date because of the large amount of work involved and the limited time in which to do it.

The four reactor technologies to be considered were identified by the Department to be the Heavy Water Reactor (HWR), the High Temperature Gas-Cooled Reactor (HTGR), the Light Water Reactor (LWR), and the Liquid Metal Reactor (LMR). Production of tritium is the primary mission of the NPR.

The Board formed a Panel of 19 experts to help perform the assessment. The Panel provided technical background and current information for use by the ERAB in completing its assessment. The Panel was chaired by Dr. Larry Papay, a long-standing member of ERAB and Senior Vice President of the Southern California Edison Company. The Panel included individuals with wide experience in the management of reactor facilities, nuclear engineering, engineering of large energy systems, safety and environmental concerns, and physics.

The Panel was divided into four subpanels, each concentrating on one of the four technologies. Each Subpanel chairman was assisted by one or two additional technical experts to help evaluate the technical information that was presented by proponents for each of the reactor types and assist in drafting the reports. The DOE also provided a technical and administrative support team of DOE and contractor staff to help organize, assimilate, and evaluate in-depth the information.

The first ERAB meeting on this subject was held on February 10 and 11, 1988. The Board approved then an interim report on the assessment of the Department's selection criteria to the Secretary as requested on March 1, 1988. During preparation of the Interim Report, the Board requested clarification from the Secretary on the extent to which it should evaluate duality features; that is, diversity of reactor technologies on more than one site. The Secretary responded with a letter on April 28, 1988 specifically requested the ERAB to include duality issues in its assessment of the reactor technologies.

The Panel had several meetings during March and April to receive information from proponents of the various technologies and to examine classified material related to production technologies. The ERAB met for three days on June 13-15, 1988 to formulate its findings and to prepare its report to the Secretary.

The ERAB does not make recommendations in this report and does not rank or directly compare the four technologies. We were not asked to do so. Rather, we assess each of the technologies according to the criteria and consider risks and benefits. The report presents fourteen findings and a table of strengths and weaknesses of each technology when used for a NPR.

It may be useful to briefly state some of the findings of the ERAB in each of the areas of the Secretary's charge:

Criteria

The Board emphasized that the ability to meet safety and environmental requirements in the Department's suggested set of criteria should be of equal importance to the criterium on the ability to produce goal quantities of tritium on a timely schedule, and that these two should be the primary criteria.

Adequacy of Technologies to Meet the Criteria

The Panel realized early in March that the target technology is a key technical feature that discriminates between the four reactor technologies. The target technology refers to the lithium targets that are inserted into the reactor to absorb neutrons and produce tritium. The HWR has a fully developed and proven target technology as a result of our long experience at the Savannah River Plant, while the other reactor types require further research, development, or testing.

The Board believes that the design features of the NPR should take full advantage of the results of reactor safety research and operational experience to date, and that the safety performance of the NPR should be at least equivalent to that of the best of present commercial power reactors.

Each of the technologies are expected to meet the requirements of a safety review process, although some technologies will take more time to obtain the necessary data and analysis capability than others. The Board urges the Department, in consultation with independent safety overview bodies, to establish the review process for the NPR project without delay.

The schedule and cost data that was presented to the ERAB and its Panel was judged to be preliminary, and useful only for qualitative comparisons. The information was prepared originally for other purposes and on a different basis in each case. In regard to schedule and cost, the report notes that successful development, design, construction, and startup of a NPR requires a continued commitment from both the Executive Branch and the Congress over many years.

The Board considered the possibility of completion of the WNP-1 Light Water Power Reactor on the Hanford site and conversion to tritium production as a NPR. We treated this a bit separately from our assessment of the basic technologies because it is a specific piece of hardware. We recognized that it was an important consideration because it offers the possibility of a shorter schedule and lower initial costs than that of a new reactor of any type. We were concerned, however, about uncertainties of the schedule associated with the WNP-1 because of the need to develop the target technology, the time needed to implement the legal processes to acquire the reactor, and the uncertainty of obtaining public acceptance of conversion of a commercial reactor to defense applications.

Risks, Benefits and Costs

The ERAB noted that a very important factor in assuring safe and reliable production of nuclear materials is the maturity of the reactor and target technology. The HWR has an advantage in this respect.

The use of multiple smaller reactors of a given type offer advantages of protection against loss of all capacity, flexibility of operation and production, and increased potential for the use of passive safety features, but at some added cost. The ERAB believes that the use of multiple, smaller reactors should be considered for any technology that is selected.

The use of multiple reactors with diverse technologies and located at separate sites offers additional benefits of providing higher production assurance, reduced uncertainty in the schedule, and less technical risk, but again at higher cost. A single unit NPR is the lowest initial cost option, but carries the operational risk of unexpected loss of all capacity for an extended period. If a single-technology option were selected, it would be prudent to develop target technologies for other reactor types to provide for future contingencies.

The most significant effect on overall cost of the NPR would come from the revenue gained by the sale of energy produced by the NPR. The amount of this revenue cannot be determined accurately at this time. The sale of steam to a utility for conversion to electricity is preferred to the generation of power by the NPR because defense material production would be better separated from electric power production, the initial investment would be reduced, and external institutional interactions with regulatory agencies and utility customers would be reduced. The revenue to be gained can only be determined accurately by negotiations with electric utilities at the potential sites.

I have rather briefly summarized some of the issues that I feel are important to decisions on the NPR. I would be happy to try to answer questions on these or any other aspects of the ERAB NPR report. Thank you.

NPR TECHNOLOGY ASSESSMENT MEMBERS

NAME	EXPERTISE	EXPERIENCE AREAS
L. PAPAY, CHMN. Senior VP Southern CA Edison Company Rosemead, CA	Engineer, Ph.D.	Senior Utility Executive, Advanced Energy R&D.
F. BARANOWSKI Consultant Williamsburg, VA	Chemical Engineer	Former DOE Officer, Nuclear Fuel Cycle and Production.
W. BEHNKE Vice Chairman Commonwealth Edison Chicago, IL	Engineer	Senior Utility Executive, Member Nat. Acad. Engin.
V. BOYER Consultant Phil. Electric Co. Philadelphia, PA	Nuclear Engineer	Senior Utility Executive, Nuclear Operations, Member Nat. Acad. Engin.
F. BUCKMAN President Consumers Power Jackson, MI	Nuclear Engineer, Ph.D.	Senior Utility Executive, Nuclear Facilities Mgmt. & Operations.
R. BUDNITZ President Future Resources Associates Berkeley, CA	Physicist, Ph.D.	Environmental Systems and Technology.
F. CULLER President Emeritus EPRI Palo Alto, CA	Energy Engineer	Senior Utility R&D Executive, Former Dep. Dir. ORNL, Numerous Awards, Member Nat. Acad. Engin.
J. GAVIN President, Emeritus Grumman Corporation Bethpage, NY	Aerospace Engineer	Senior Aerospace Exec., Former Pres., Chief Oper. Ofcr., and Dir. Grumman Corp., Member Nat. Acad. Engin.

R. GENS Consulting Engin. Portland, OR	Electrical Engineer	Former Chief Engin. Bonneville Power Admn., Elec. Transmission
J. GILBERT Vice President NJG Incorporated Germantown, MD	Engineer	Former DOE Official, Nuclear Safety & Strategic Materials Prod.
J. GRAY President ERC International Fairfax, VA	Chemical Engin.	Nuclear Industry Resource & Mgmt., Energy & Nuclear Fuels Policy
J. HENDRIE Senior Consultant Brookhaven National Lab Upton, NY	Physicist, Ph.D.	Former Chrmn NRC, Reactor Design, Mem. Nat. Acad. Engin.
K. LATHROP Assoc. Dir., Techn. Div. SLAC Stanford, CA	Engin., Physicist, Ph.D.	Reactor Physics, Safety & Computer Systems
R. PATRICK Francis Boyer Chair Acad. Nat. Sciences Philadelphia, PA	Botanist, Ph.D.	Limnology, Ecosystems, Environ. Policy, Mem. Nat. Academy Sciences
D. PIMENTEL Professor Cornell University Ithaca, NY	Entomologist, Ph.D.	Prof. of Ecology & Agricultural Science, Environ. Resource Mgmt. & Pollution, many Policy Advisory Panels
L. RODDIS Consulting Engin. Charleston, SC	Mechn. Engineer	Former Board Member & Pres. Consolidated Edison Co., NY, Nucl. Navy & Utilities, Mem. Nat. Acad. Engin.

J. SCHOETTLER Independent Petroleum Geologist Parker, CO	Geologist	Petroleum, Chairman Energy Research Advisory Board
N. TODREAS Head, Dept. Nuclear Engineering, MIT Cambridge, MA	Nuclear Engineer, Ph.D.	Educator, Dept. Chairman, Broad nuclear experience
A. WEINBERG Disting. Fellow Institute for Energy Analysis, Oak Ridge, TN	Physicist, Ph.D.	Eminent Nuclear Scien., Science Policy & Energy Analysis, numerous honors, Former Dir. Fed. Energy Admn. Mem. Nat. Acad. Sci. & Engin.

NEW PRODUCTION REACTOR
SUBPANEL ASSIGNMENTS

LIGHT WATER REACTOR (LWR)

Floyd Culler, Chairman
Ralph Gens
Kaye Lathrop
Ruth Patrick

Ed Zebroski - Advisor

LIQUID METAL REACTOR (LMR)

Lou Roddis, Chairman
Wallace Behnke
Frank Buckman
Robert Budnitz
John Gray

Robert Avery - Advisor

HIGH TEMPERATURE/GAS COOLED REACTOR (HTGR)

John Gilbert, Chairman
Vince Boyer
Joseph Gavin
Alvin Weinberg

Don Trauger - Advisor

HEAVY WATER REACTOR (HWR)

Neil Todreas, Chairman
Frank Baranowski
Joseph Hendrie
David Pimentel

Frank Kruesi - Advisors
Milton Shaw

MEETINGS HELD BY ERAB AND ITS PANEL
ON
THE NEW PRODUCTION REACTOR TECHNOLOGY ASSESSMENT

Jan. 22, 1988	NPR Steering Committee	Los Angeles, CA
Feb. 10-11, 1988	ERAB Meeting	Washington, DC
Feb. 11-12, 1988	NPR Panel - Initial Meeting	Washington, DC
March 1-2, 1988	LWR Subpanel	Albuquerque, NM
March 3-4, 1988	LMR Subpanel	Albuquerque, NM
March 7-8, 1988	HTGR Subpanel	Germantown, MD
March 9-11, 1988	HWR Subpanel	Boston, MA
March 23-24, 1988	NPR Panel - Tritium Technology	Argonne, IL
April 19, 1988	Subpanel Meetings	Los Angeles, CA
April 19-20, 1988	NPR Panel - Consolidate Information	Los Angeles, CA
May 24, 1988	NPR Panel - Final Meeting	Washington, DC
June 13-15, 1988	ERAB - Findings and Report	Livermore, CA

STATEMENT OF WILLIAM R. GRAHAM, SCIENCE ADVISOR TO THE PRESIDENT; AND DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY, EXECUTIVE OFFICE OF THE PRESIDENT

Senator JOHNSTON. May we proceed next to Dr. William Graham.

I would like for all witnesses to stay at the table, if you would, and thenwe can have questioning of the entire group as one panel.

Mr. GRAHAM. Thank you, Mr. Chairman.

I am testifying here today as the Director of the Office of Science and Technology Policy. I appreciate the invitation to testify before you and also appreciate Energy Secretary Herrington's invitation to consult with him as he prepares to address the subject of the new production reactor.

Secretary Herrington is, as you know, a valued member of the President's Cabinet, and it is a pleasure to work with him and his associates, including Under Secretary Salgado to my right and Acting Assistant Secretary Wade who was here a moment ago. Of course, the Department of Energy is also consulting with Secretary Carlucci and Director Duncan who are here with us today.

The key issue facing the United States in this area is the reliable, long-term availability of the tritium supply used primarily in nuclear weapons. Of course, this supply must be produced in a safe and environmentally sound manner. As you have heard, the Energy Research Advisory Board has recently completed its review of the four technologies for an NPR and a number of options for employing those technologies.

The ERAB report noted that all of the technologies were capable of producing tritium and noted that different technologies had different advantages and different weaknesses.

The ERAB report also noted the critical importance of the safety and environmental evaluation and review process. I anticipate that the review process for an NPR, when it is fully established by the Secretary of Energy, will be as rigorous as the process for commercial power reactors. Therefore, the time required for a new production reactor or reactors to reach operational status will depend at least as much on the time required for safety and environmental evaluation and review as it will on the specific development and construction schedule.

My final comment concerns reactor costs and schedule. The current costs and schedule estimates for the various options are very preliminary. It is my view that these current estimates of discounted NPR lifecycle costs and schedules are all within the same range of uncertainty.

This completes my testimony, Mr. Chairman, and I will be pleased to entertain your questions.

Senator JOHNSTON. Thank you very much, Mr. Graham.

[The statement follows:]

STATEMENT OF WILLIAM R. GRAHAM

Thank you for this opportunity to testify on the subject of a new nuclear materials production reactor [NPR]. I appreciate your invitation, and also appreciate Secretary Herrington's invitation to consult with him as he prepares to address the subject of the NPR. Secretary Herrington is a valuable member of the President's Cabinet, and it is a pleasure to work with him and his associates, including Under Secretary Salgado and Acting Assistant Secretary Wade, who are here today. Of course, the Department of Energy is also consulting with Secretary Carlucci and Undersecretary Duncan, who is also with us today.

The key issue facing the United States today in this area is the reliable long-term availability of the tritium supply used primarily in nuclear weapons. Of course, this supply must be produced in a safe and environmentally sound manner. As you have heard, the Energy Research Advisory Board [ERAB] has recently completed its review of four technologies for an NPR, and a number of options for employing those technologies.

The ERAB report noted that all of the technologies were capable of producing tritium, and also noted that different technologies had different advantages and different weaknesses.

The ERAB report also noted the critical importance of the safety and environmental evaluation and review process. I anticipate that the review process for an NPR, when it is fully established, will be as rigorous as the process for commercial power reactors. Therefore, the time required for a new production reactor, or reactors, to reach operational status will depend at least as much on the time required for safety and environmental evaluation and review, as it will on the specific development and construction schedule.

My final comment concerns reactor cost and schedule. The current cost and schedule estimates for the various options are very preliminary. It is my view that all of these current estimates of discounted NPR life-cycle costs and schedules are within the same range of uncertainty.

This completes my testimony. I would be happy to entertain any questions.

STATEMENT OF ROBERT C. DUNCAN, DIRECTOR, DEFENSE RESEARCH AND ENGINEERING; AND CHAIRMAN, NUCLEAR WEAPONS COUNCIL

Senator JOHNSTON. Dr. Duncan.

Dr. DUNCAN. Good morning, Mr. Chairman and members of the committee.

Let me express my appreciation also for being invited to appear as a witness in support of this very important national security project that we are talking about. I intend to provide very brief remarks on several aspects related to the Department of Defense's position on the NPR capacity.

I endorse the Department of Energy's process for developing their acquisition strategy for the new production reactor capacity. We respect the Department of Energy's prerogative to formulate such recommendations and, ultimately, to reach a decision on this critical project. The Department of Energy has provided us with briefings and appropriate reports on those aspects of the NPR related to technologies and sites.

These reports, as they are completed, were made available to the Nuclear Weapons Council, which I chair, and to other offices within the DOD. We have participated in the process in part by providing Nuclear Weapons Council comments and recommendations on those aspects related to the nuclear weapons stockpile and other Defense-related matters as the Secretary of Energy moves toward his decision on the NPR.

The DOD has established a requirement that this country must have a safe and assured source of tritium for the foreseeable future. For the past 40 years, nuclear weapons have been a primary element in this nation's strategy of deterrence. Although the capability of conventional weapons continues to be improved, nuclear weapons for the foreseeable future remain essential to our national well-being.

The Defense Department continues to work with the Department of Energy to identify and maintain the stockpile quantities consistent with our planned national strategies and needs. The continuing effectiveness of the nation's nuclear stockpile is dependent on the Department of Energy's capability to produce tritium. The short half-life of this critical element dictates the need for a continuous and reliable supply.

We are aware that the DOE has under review an array of alternative combinations of reactor technologies and sites. Were it DOD's judgment that they are required to construct more than one reactor to ensure reliability in tritium production, the Defense Department is prepared to seriously consider that strategy.

Throughout this process, DOD has endorsed the principle that the costs of tritium production capability should be minimized consistent with safety and reliability of supply. The importance of moving expeditiously toward establishing a new production capability must not be overlooked.

Because of the many uncertainties and complexities involved, this nation has postponed those vital steps now being taken by DOE to replace our aging and reduced-capacity production reactors. We need to complete thorough but timely planning, programming, and budgeting activities for the new production reactor as a matter of high national priority.

In closing, let me state that DOD is fully supportive of this important DOE endeavor and is appreciative of the continuing support and bipartisan cooperative leadership of the Congress in moving to restore an assured supply of the materials crucial to the national security of this nation.

Thank you.

[The statement follows:]

Statement of Robert C. Duncan

MR. CHAIRMAN, MEMBERS OF THE COMMITTEE, LET ME EXPRESS MY APPRECIATION FOR BEING ASKED TO APPEAR AS A WITNESS IN SUPPORT OF THIS MOST IMPORTANT NATIONAL SECURITY PROJECT. I INTEND TO PROVIDE BRIEF REMARKS ON SEVERAL ASPECTS RELATED TO THE DEPARTMENT OF DEFENSE (DOD) POSITION ON NEW PRODUCTION REACTOR (NPR) CAPACITY.

I ENDORSE THE DEPARTMENT OF ENERGY'S PROCESS FOR DEVELOPING AN ACQUISITION STRATEGY FOR THE NEW PRODUCTION REACTOR CAPACITY. I RESPECT THE DEPARTMENT OF ENERGY'S (DOE) PREROGATIVE TO FORMULATE SUCH RECOMMENDATIONS AND, ULTIMATELY, TO REACH A DECISION ON THIS CRITICAL PROJECT. I APPRECIATE THE OPPORTUNITY THE PROCESS PROVIDES FOR INTERAGENCY REVIEW. THE DOE HAS PROVIDED US WITH BRIEFINGS AND APPROPRIATE REPORTS ON THOSE ASPECTS OF THE NPR RELATED TO TECHNOLOGIES AND SITES. THESE REPORTS, AS THEY ARE COMPLETED, WERE MADE AVAILABLE TO THE NUCLEAR WEAPONS COUNCIL AND TO OFFICES WITHIN THE DOD. WE HAVE PARTICIPATED IN THE PROCESS IN PART BY PROVIDING NUCLEAR WEAPON COUNCIL COMMENTS AND RECOMMENDATIONS ON THOSE ASPECTS RELATED TO THE NUCLEAR WEAPONS STOCKPILE AND OTHER DEFENSE-

RELATED MATTERS AS THE SECRETARY OF ENERGY MOVES TOWARD HIS DECISIONS ON THE NPR.

THE DOD HAS ESTABLISHED THE REQUIREMENT THAT THIS COUNTRY MUST HAVE A SAFE AND ASSURED SOURCE OF TRITIUM FOR THE FORESEEABLE FUTURE. FOR THE PAST 40 YEARS, NUCLEAR WEAPONS HAVE BEEN A PRIMARY ELEMENT IN THIS NATION'S STRATEGY OF DETERRENCE. ALTHOUGH THE CAPABILITY OF CONVENTIONAL WEAPONS CONTINUES TO BE IMPROVED, NUCLEAR WEAPONS (for the foreseeable future) REMAIN ESSENTIAL TO OUR NATIONAL WELL-BEING. THE DEFENSE DEPARTMENT CONTINUES TO WORK WITH DOE TO IDENTIFY AND MAINTAIN THE STOCKPILE QUANTITIES CONSISTENT WITH OUR PLANNED NATIONAL STRATEGIES AND NEEDS. THE CONTINUING EFFECTIVENESS OF THE NATION'S NUCLEAR STOCKPILE IS DEPENDENT UPON DOE'S CAPABILITY TO PRODUCE TRITIUM. THE SHORT HALF-LIFE OF THIS CRITICAL ELEMENT DICTATES THE NEED FOR A CONTINUOUS AND RELIABLE SUPPLY.

WE ARE AWARE THAT THE DOE HAS UNDER REVIEW AN ARRAY OF ALTERNATIVE COMBINATIONS OF REACTOR TECHNOLOGIES AND SITES. WERE IT DOE'S JUDGMENT THAT THEY ARE REQUIRED TO CONSTRUCT MORE THAN ONE REACTOR TO ENSURE RELIABILITY IN TRITIUM PRODUCTION, THE DEFENSE DEPARTMENT IS PREPARED TO SERIOUSLY CONSIDER THAT STRATEGY.

THROUGHOUT THIS PROCESS, DOD HAS ENDORSED THE PRINCIPLE THAT THE COSTS OF TRITIUM PRODUCTION CAPABILITY SHOULD BE MINIMIZED CONSISTENT WITH SAFETY AND RELIABILITY OF SUPPLY. THE IMPORTANCE OF MOVING EXPEDITIOUSLY TOWARD ESTABLISHING A NEW PRODUCTION CAPABILITY MUST NOT BE OVERLOOKED. BECAUSE OF THE MANY UNCERTAINTIES AND COMPLEXITIES INVOLVED, THIS NATION HAS POSTPONED THOSE VITAL STEPS NOW BEING TAKEN BY DOE TO REPLACE OUR AGING AND REDUCED-CAPACITY PRODUCTION REACTORS. WE NEED TO COMPLETE THOROUGH, BUT TIMELY, PLANNING, PROGRAMMING AND BUDGETING ACTIVITIES FOR THE NPR AS A MATTER OF HIGH NATIONAL PRIORITY.

IN CLOSING, LET ME STATE THAT THE DOD IS FULLY SUPPORTIVE OF THIS IMPORTANT DOE ENDEAVOR AND IS APPRECIATIVE OF THE CONTINUING SUPPORT AND BIPARTISAN COOPERATIVE LEADERSHIP OF THE CONGRESS IN MOVING TO RESTORE AN ASSURED SUPPLY OF THE MATERIALS CRUCIAL TO THE NATIONAL SECURITY OF THIS NATION.

Senator JOHNSTON. Mr. Wade.

Mr. WADE. I do not have a statement, Mr. Chairman. I am just prepared to respond to questions.

Senator JOHNSTON. That is fine, because the questions are the most important part anyway.

Thank you very much gentlemen.

RISKS ASSOCIATED WITH EXISTING PRODUCTION REACTORS

Mr. Salgado, first of all, let me understand what the risks are with respect to our present reactors at Savannah River. They are aged. They are operating now at 50 percent of capacity.

What are the risks? They are not the same as the N Reactor with no containment facilities, are they? Is that the kind of risk we are talking about?

Mr. SALGADO. There are several issues, Mr. Chairman.

No. 1, they do not have containment either, such as the N Reactor, being built 34 years ago. They have a confinement system, which has been reviewed both by independent bodies of the National Academy of Sciences and is currently being, I believe, reviewed by Mr. Ahearne's group.

The other component here is that when the National Academy of Sciences did a review of the heavy water reactors at Savannah River, they determined that the data base of those reactors, what they were operating on, was insufficient to support those operating power levels. In an abundance of caution, those power levels were reduced to 50 percent power.

So, currently, at this particular time, they are operating at 50-percent power, and what is known as the PRA, a probalistic risk assessment, is currently taking place to determine the correct power levels or to substantiate those existing power levels that we were operating at now. This computer data base analysis is currently undertaken now to establish power levels.

Also, there are ongoing safety reviews of those particular reactors, both in the seismic area and other emergency core cooling systems. So, there is an ongoing review of these reactors to ensure that they are meeting all potential safety features that they can meet due to their age and any upgrades that are needed to maintain the activities. They are fragile in nature and there are many costs involved to maintain these.

Senator JOHNSTON. When you say that they are fragile, does that mean that we face the real danger of a meltdown, or is it fragile in that you might have to turn them off, or both?

Mr. SALGADO. Sir, when I say "fragile," I mean the ability to keep operating these for another 10 to 15 or 20 years, and to postpone a new production reactor is unwise. When I say that they are fragile, they have operated for 34 years, and if we started building a new production reactor today—that is a 10-year leadtime—it means those reactors are going to have to operate for 44 years. I believe that in the commercial world, the life expectancy for reactors is something like 20 to 30 years.

OPERATIONAL SAFETY

Senator JOHNSTON. I am trying to get at what is the risk of operating these reactors. I mean, it looks to me like you are going to have to operate them another 10 years anyway.

Mr. SALGADO. I think that there is a risk.

Senator JOHNSTON. What risk?

Mr. SALGADO. The risk that those reactors, for any particular reason, will not be able to continue to operate.

Senator JOHNSTON. The risk is one of not being able further to operate over a period of time, and not of safety, or is it both?

Mr. SALGADO. As far as we are concerned, in the Department, ongoing safety analyses are taking place, and the fact of the matter is that although they do not meet current standards, they are safe to operate. The risk is that we will not be able to continue to operate them for the long period of time for a new production reactor to come on line.

SAFETY PROBLEMS BEING ADDRESSED

Senator JOHNSTON. So you see no safety problem.

Mr. SALGADO. There are safety problems there, Mr. Chairman. There are ongoing safety problems.

Senator JOHNSTON. What are those safety problems?

Mr. SALGADO. I could ask Mr. Wade to enunciate more clearly some of them. Some of them have been in the seismic area, one of the emergency core cooling systems was not currently braced for appropriate seismic standards. There is an ongoing effort as to the emergency core cooling system in the testing of the fourth loop on the L Reactor, I believe. Mr. Wade may be able to enunciate some additional things that we are looking at.

Senator JOHNSTON. Yes, would you explain?

Mr. WADE. Mr. Chairman, the National Academy of Sciences review confirmed our concern about the operating of the emergency core cooling system at maximum power levels. Until we can satisfy both ourselves and the National Academy, through Mr. Ahearne's committee, that we can return to power levels, we are running at 50-percent power. We are adding, as the reactors are down for routine maintenance, a fourth emergency core cooling system loop which will help alleviate that problem.

In addition to the concerns about emergency core cooling, we have done some things to increase the seismic safety of the plants to conform to today's standards. Fire protection has been a concern, and operator training systems has been another concern.

We do not, at this point in time, know of anything in a generic sense that would cause us to not be able to operate those plants. But as Deputy Secretary Salgado said, they are 34 years old now. We are going to have to run them for another decade at least. They are not unsafe to run, Senator. The risk is their ability to supply the nation's need of tritium. In my mind that is the biggest risk.

Senator Johnston. That really is the ultimate question. You see no safety problem here; essentially, it is a problem of perhaps having to shut them down because of inability to run them safely. But you would see that safety problem coming and would be able to anticipate it by either reducing power or shutting them down. Is that what you are saying?

REDUCTION IN POWER

Mr. Wade. Yes, sir. We have reduced them in power to assure that we do not have a safety problem. We have increased our level of conservatism and safety by reducing the power to 50 percent. It is our hope that we can ascend in power over the next couple of years, but they are not unsafe reactors.

Senator Johnston. All right, I am glad to know that.

Now you have one reactor, of the four at Savannah River, that is making tritium, and three that are making plutonium; is that right?

Mr. Salgado. No, sir.

Senator Johnston. What is it?

Mr. Salgado. Actually, the L Reactor has a plutonium load and the P and the K Reactors are on tritium. The C Reactor is no longer functioning because of the unique configuration of the vessel. C Reactor is down and will not be repaired in the foreseeable future. So there are two reactors on tritium at 50-percent power, and one reactor has the capability for plutonium production at 50-percent power.

Senator McClure. We should add at that point that the fourth one is closed down because of a safety defect.

Mr. Salgado. The C Reactor, because of cracking in the vessel, and the configuration of that vessel, is down, and there is no known means to repair that at this particular time. So three reactors is our capability, and they are at 50-percent power, sir.

Senator Johnston. You say that you hope you can increase that power from 50 percent.

Mr. Salgado. Yes, sir.

Senator Johnston. What would you do to increase it from 50 percent?

Mr. Salgado. The database, the underlying models to be utilized, what they call the PRA's, the probabilistic risk assessments, have to take place in order to satisfy an independent body, as well as ourselves, that the power levels are well documented, and the conservative margin of safety is documented.

What has happened is that when an analysis was done by the National Academy of Sciences of those three reactors that are operating, they said that the data that you are utilizing to support those power levels is insufficient. They didn't say that we are operating them unsafely; they just said that there were insufficient data to support those power levels, and in an abundance of caution they were reduced in power.

CONVERSION TO TRITIUM PRODUCTION

Senator JOHNSTON. The third reactor, which is producing plutonium, or prepared to produce plutonium, in a pinch, could you convert that to tritium, and if so, how much time would it take and at what cost, roughly?

Mr. SALGADO. There are relatively very little costs involved. It is the same generic design as the other P and K Reactors. When the L Reactor came back on line, Senator, it had been down for approximately 17 years. So, its use time could be as much as 17 years less than the other two reactors.

Senator JOHNSTON. Do you mean 17 years more?

Mr. SALGADO. No, less. It was down, it was not operating for 17 years, and it was brought back in the early 1980's when it was demonstrated that we needed more capacity within the system. So it is 17 years younger, if you would say, just in use time.

Essentially, what occurred is a determination in the early 1980's was made to bring it back to produce only plutonium.What would have to occur now would be to go back within the environmental process, I believe either an environmental impact statement or an environmental assessment, to permit it to produce tritium. There are no technical reasons and there are no other additional great burdens.

Senator JOHNSTON. The question is, how much time would it take?

Mr. WADE. We have that under review right now, Senator. We hope, when the reactor comes back on line at the end of this year, at the end of its scheduled outage, that we will have completed the necessary environmental work and we can restart it on a tritium load. So our goal is the end of this year.

Senator JOHNSTON. So you would have three operating on tritium?

Mr. WADE. Yes, sir.

Senator JOHNSTON. Do you need three operating on tritium?

Mr. SALGADO. Sir, we feel, obviously, that we do need it for two reasons. First of all, in fact, because of these outages that have occurred in them, we would like to maintain some surplus of tritium for future and long-term planning. I think that it is in the best interest, No. 1, to have the capability to go on tritium; and No. 2, to preproduce some tritium in case of any contingencies. As long as the demand on the other side for plutonium allows this approach.

Senator JOHNSTON. Would it have to be operated at 50 percent, too?

Mr. SALGADO. Yes, sir, the same issue addressed for the other reactors is also applicable for the L Reactor.

Senator JOHNSTON. So with the three at 50 percent, you would have some excess capacity?

Mr. SALGADO. Marginal.

Senator JOHNSTON. You would hope, through getting additional data, to be able to go higher than 50 percent?

Mr. SALGADO. That is the projection, and that is at least 1½ or 2 years out.

Senator JOHNSTON. What I am really trying to get at is, what the constraints are in terms of the emergency. How much time do we have to deal with here?

Mr. SALGADO. I think the time that we have to deal with is the time it takes, basically, to build a new production reactor and meet the safety and environmental concerns, because I do not believe that the country can afford any delay. We have to move forward aggressively.

REACTOR SITING CONSIDERATIONS

Senator JOHNSTON. Let me ask just a couple more questions, because I don't want to take all the time here. Any of these reactors—the heavy water, the HTGR, et cetera—they can all be built at any of the sites. There is no site specific; is that right?

Mr. SALGADO. Technically, that is correct, Mr. Chairman. I think that the heavy water reactor, because of an infrastructure that has to support that reactor—for example, on the decladding of the fuel and how it functions—there is an additional cost that would have to occur if we were to build a heavy water reactor some place other than Savannah River, because that infrastructure dealing with heavy water type technology and its fuel is already in existence and in place.

If we were to build a high-temperature gas reactor at any of the sites, there would be additional infrastructure that would have to be built around that, and I believe that is a common denominator to all of them.

Senator JOHNSTON. In other words, heavy water would favor Savannah River, and any of the others can be built with equal facility anywhere.

Mr. SALGADO. Yes, sir.

INHERENTLY SAFE REACTOR TECHNOLOGY

Senator JOHNSTON. I have always felt, and I very strongly feel now, that we ought to be able to develop an inherently safe reactor for our civilian market. I am wondering what risks we would run. As I read your report, it indicates that it is not as mature a technology, might take a little longer, and it might cost more. But your degree of confidence in being able to do it is relatively high; is that correct?

Mr. SALGADO. That is the ERAB report, and that is their basic conclusion. That is correct, sir.

Senator JOHNSTON. How much more time do you expect that it would take?

Mr. SALGADO. I would have to deflect that to Mr. Schoettler from the ERAB report.

Mr. SCHOETTLER. All of the timeframes, Mr. Chairman, were in the area of approximately 10 years or slightly less.

Senator JOHNSTON. What do you mean by the timeframes?

Mr. SCHOETTLER. For the four different technologies.

Senator JOHNSTON. There is not much difference between them?

Mr. SCHOETTLER. I think the ERAB report concluded that there were varying degrees of additional research and development, particularly on the target technology for the advanced reactors that had to take place, but the overall timeframes did not vary particularly. If you did go to modularity or to smaller sizes, there was a thought that there could be an incremental production of the modular type reactors where some would begin to come on line or into production prior to others.

If the HTGR were used to produce full goal quantities of tritium for U.S. needs, there would, perhaps, be as many as eight of the modular HTGR's in two separate four-group blocks. The initial ones as they were produced and put on stream could begin producing tritium, so you wouldn't have to wait 10 or 12 years to get all eight to produce tritium, you could begin, perhaps, as early as 7, 8, or 9 years from the time the decision was made.

BENEFITS TO NUCLEAR POWER PRODUCTION

Senator JOHNSTON. I am taking too long here, so I am going to give up the floor, except to say that I am expressing a desire for an inherently safe technology to be developed out of this, if possible. I mean not at all to prefer one site over the other, and I want to say that for my friend from South Carolina, because I don't want to have to bear the burden of that argument in trying to build an inherently safe reactor.

We need, in my view, to go to nuclear energy. We are having global warming hearings in the Energy Committee right now, and that is one of the obvious conclusions that comes up, that you need to go to nuclear energy. The light water reactors, while they have a very good safety record, are not perceived as being safe, and the regulatory scheme is such that they can't be built quickly enough because of the safety problems.

So, if we can develop an inherently safe reactor, I think that we ought to do it. It would be worth it to do it, but I don't, as I said, prefer one site over the other in trying to solve the energy problems of the country.

Senator McClure.

FUTURE DIRECTION OF PRODUCTION TECHNOLOGIES

Senator MCCLURE. Thank you very much.

I have a number of questions, and I will try to ask what I think are the most important ones first, and then yield to my friend from South Carolina so that he can ask some questions, too, in the time that we have available. I hope I don't overlook some of the more important questions in trying to fit it within the timeframe.

I, again, want to express my thanks to each of you for your willingness to be here and to participate in this process. But I don't really want to dwell on the question of the current safety of the Savannah River reactors, because I think that it is essential to understand that the production at Savannah River reactors is currently absolutely essential to the security of this country. I don't want the President of the United States, this one or any future one, to have to compromise public safety in order to meet national security goals.

I don't want to either understate or brush aside the very legitimate concerns that many have suggested with respect to the operation of the Savannah River plants today, but rather than dwell upon the past and where that leaves us today, I want to concentrate for a moment on what that should tell us our direction should be toward the future.

There is a timelag. We are stuck with the condition we have now. We can't escape that, because there is a timelag to come to the replacement. I don't even want to go back over the decision that was made a few years ago not to go forward with the NPR, because I think everybody now knows we should. There is no debate on that issue. So the question is how to go about it, rather than whether or not we should do it.

One of the problems I have that grows out of this discussion is to try to make certain that people understand that my goal isn't simply to get a reactor built in Idaho. I keep getting that from my friend from South Carolina, and it just isn't true. I want this country to build essential facilities for the security of this country in the best possible way. If that happens to fit in Idaho, fine, I would welcome it, so would everyone I know of in Idaho, except the few who are against anything that is nuclear, and there are some who are against anything that is nuclear.

HEAVY WATER REACTOR DESIGN IMPROVEMENTS

In that context, we ought to look not as a criticism of the current reactors, or a criticism of heavy water reactors, because I don't want to be understood as opposing heavy water reactors. I do want to be understood, however, that there are some real questions in the choice of technology. I think that it is fair to say that before you can move forward on a new heavy water reactor, you would have to do things that haven't been done with respect to the current heavy water reactors.

Mr. Schoettler, is that not correct?

Mr. SCHOETTLER. Yes. I think that the National Academy report pointed out either design flaws or safety problems with those reactors, as you observe, and now having identified those safety issues, it is my understanding that they are being addressed by computer analysis in the hopes that they could be overcome in the design for a new or advanced HWR.

NRC REVIEW

Senator MCCLURE. It may well be that the building of reactors to meet the nation's security requirements, the materials requirements for our weapon stockpile, that we will not subject those plants to NRC review. I don't know what that decision will ultimately be, but they are going to either go through an NRC review, or something that parallels an NRC review. Is there any disagreement among anybody on this panel with that statement?

Mr. SALGADO. The Department's position is that given the creation of the new Nuclear Safety Board, which will be enacted with the signing of the defense authorization bill, that that is an independent body appointed by the President, and confirmed by Congress, and will probably be the Board upon which are the dynamics of safety, so we will use that Board.

Senator McCLURE. But they will likely establish similar standards and similar processes to that which have been established by NRC; is that not correct?

Mr. SALGADO. We would hope so.

Senator McCLURE. We are not anticipating that somehow, because these are government operated for weapons production, that they are going to be permitted to operate with less safety in mind than NRC requires for commercial reactors.

Mr. SALGADO. That is correct, Senator.

Senator McCLURE. We need to be right up front in this process of saying to the American public that that is what we expect will happen with an NPR program.

Mr. SALGADO. That is correct.

Senator McCLURE. In that process, NRC identifies various levels of consequences of various kinds of accidents. NRC has established various classes of potential accidents that might occur. I think that it is safe to say that the current reactors at Savannah River would not meet those kinds of safety reviews. Therefore, it is impossible for us to hypothesize simply building new heavy water reactors of the type and design that are now operating at Savannah River. Is there any disagreement with that statement?

If that is true, then, the reactors that will be built for new production capacity will be new designs. They will be updated designs. They will be unlike anything that is built today in several very important aspects.

Let's take, for example, the fuels that are loaded at Savannah River today would not meet the requirements of a class IX accident under NRC standards; is that correct?

Mr. SALGADO. That I am not quite sure.

Senator McCLURE. A meltdown would occur of those fuels, not a meltdown of the plant. I am not talking about China syndrome; I am talking about the meltdown of the fuel elements because of the rapid heat excursion under a class IX accident.

Mr. SALGADO. I can get that for the record. Mr. Bunch indicates that it is one of the things that needs to be looked at because it has the possibility to lead us into trouble. I don't have a definitive answer to your question, but I will provide it for the record.

[The information follows:]

CLASS IX ACCIDENT

Fuel elements in the Savannah River reactors would indeed melt under hypothetical conditions in which all liquid cooling is lost. This is also true for a new heavy water production reactor using existing fuel technology. It is also true of most reactor concepts, including light water and liquid metal reactors.

Accidents that result in fuel melting due to undefined event sequences are called class IX accidents. NRC has not applied standards to these accidents, but is now in the process of developing policies to deal with severe accidents for which credible initiating mechanisms cannot be defined.

It is believed that the proposed fuel for the modular high-temperature gas reactor will not melt on loss of forced cooling. The fuel particles are encapsulated in materials having extremely high melting temperatures. This fuel technology could also be applied to heavy water reactors, but would require a development program.

Senator McClure. I don't want to lead you into statements that might lead us into trouble. I don't want any more trouble than we have. But I do want us to understand that if a heavy water reactor is the reactor of choice—and I won't resist that choice if that is what you choose, Mr. Secretary—but I do want people to understand that it would require a redesigned fuel in a redesigned plant.

Mr. Salgado. I am advised that the flow, the cooling flow, obviously, would have to be changed. and I believe the National Academy addressed that. Whether or not the fuel has to be changed is questionable, sir.

Senator McClure. But under the plant design, a meltdown of the fuel could occur.

Mr. Salgado. Given a scenario of loss of cooling flow, I believe that is correct.

Senator McClure. Those fuels, there is nothing that we know today that can meet the safety requirements of the safety codes and verification of safety codes if a meltdown of the fuel should occur?

Mr. Wade. Senator, one of the problems at Savannah River is that the entire class of accidents have not been analyzed, and that is what we are undertaking at the moment. It is thought that given a class IX kind of accident, and because of the current design of the flow in the Savannah River reactors, that you would have a void, that you would get the fuel damage, and you would have some fuel melting. That is the reason that they are powered down to 50 percent, which we believe alleviates that problem, but we cannot confirm it at this point.

Senator McClure. Mr. Wade, I think your answer is very careful and very accurate.

I don't mean to misstate or raise fears, but in order to build a new plant, meeting new standards for safety and the new review requirements that will be established on the new plant, you will be required to verify what you cannot now verify. That means the development of safety codes, and it means the verification of those codes. It may, and I stress "may," because I think you are correct, it doesn't necessarily mean redesign of the fuel, but it may require redesign of the fuel, in the heavy water reactor.

I only say that because I want to stress what Mr. Schoettler said a moment ago, the conclusion of the ERAB panel, that there is very little difference in the timeframe or the difficulty in the design and the verification of design of the competing technologies.

COMPARISON OF COMPETING TECHNOLOGIES

I guess it would be fair to say, would it not, Mr. Schoettler, the conclusion of the panel was that there is very little difference, but I guess I would hazard this much, the liquid metal reactors have much less of the preliminary work done; is that correct?

Mr. Schoettler. Yes; that was the conclusion of the panel.

Senator McClure. Therefore, it would require more work to bring the liquid metal reactors to the same state of readiness to move forward as the other candidates.

Mr. SCHOETTLER. There also did not seem to be a very strong proponent of the liquid metal reactor for use as an NPR as opposed to use for a civilian reactor. That was a distinction also that the panel drew.

Senator MCCLURE. I think that it is probably fair to say that in that hierarchy, if indeed there is to be one, and I guess that is what you, Mr. Secretary, are going to have to try to determine and sort out, that the light water reactors are probably next least ready, or slightly less ready than the heavy water, or HTGR, in terms of the preliminary work that has been done and the length of time that it would take to verify the work.

Mr. SCHOETTLER. Senator, we did not attempt to rank or compare and contrast the individual technologies. We were not asked to do that. I don't mean to avoid your question, but we were asked to evaluate the benefits and risks of each of those technologies, and the benefits of the light water reactor was that we had over 100 of them operating in this country.

One of the risks involved with it, if we can characterize it as that, is that the target technology had not been developed and it would have to be installed in either the WNP-1 after it were completed, or find a civilian nuclear reactor in which you could test that target technology, which would be very difficult.

The thrust of the ERAB report was not to attempt to really rank the different technologies as much as it was to try and aid the Department of Energy and the Secretary in making judgments as to which would best be suited for the production of tritium.

Senator MCCLURE. I don't suppose you are going to run up to Long Island and test a new target at Shoreham. [Laughter.]

Mr. SCHOETTLER. No; I don't think they would let us.

C REACTOR EMBRITTLEMENT

Senator MCCLURE. I have just one question, and let me cede the time to my colleague from South Carolina, and that has to do with what is the central concern I have tried to express, and that is to make certain that our country has production capacity which is available to meet the essential needs of this country at any given time in the future, recognizing that there are uncertainties in whatever we decide to do.

If all four of the Savannah River reactors had been designed as the C Reactor, and all four had been built on the same design and had developed the flaw that has developed in the C Reactor, is it not correct to say they would all be shut down today?

Mr. SALGADO. The only difference, I think, would probably be that it is my understanding that embrittlement, because of that unique design, was caused over the long use. L Reactor being 17 years younger, and there is a question of when the neutrons basically are the most intense, but L Reactor will probably have a little longer life.

If they all operate the same amount of time, I think that there is a reasonable assumption that, yes, Senator, they would all be down.

Senator McClure. Then we would have the L Reactor operating at half capacity, and we would be down to half a reactor. But we also probably would not have made the decision to close down the N Reactor.

Mr. Salgado. Not necessarily, because the N Reactor's benefit is on the plutonium side, and basically that is a whole separate demand and supply issue and the life cycles and cost factors involved.

Senator McClure. I understand. Thank you very much.

Let me yield the time now and I will come back later.

Senator Johnston. Senator Hollings.

SAFETY OF SAVANNAH RIVER REACTORS

Senator Hollings. Thank you, Mr. Chairman.

Mr. Secretary, we have heard a lot of talk now of closedowns, meltdowns, and high risks, but the fact of the matter is that there is no safety problem really at Savannah River now as you see it; it is a production problem. Is that correct?

Mr. Salgado. The major concern that we are dealing with is a production problem into the outyears and the quantity of tritium that we have the capability to produce.

Senator Hollings. We are operating at this moment safely at Savannah River.

Mr. Salgado. We are operating those reactors in a safe and efficient mode; that is correct.

Senator Hollings. We are not about to have a meltdown?

Mr. Salgado. Sir, if we were about to have a meltdown, they would not be operating.

Senator Hollings. Exactly; we are not about to have a closedown.

Mr. Salgado. There is not to be a closedown.

Senator Hollings. You are not stating the statement of the chamber of commerce?

Mr. Salgado. I am not stating their statement at all, Senator.

SUPPORTING INFRASTRUCTURE AT SAVANNAH RIVER

Senator Hollings. Thank you, Mr. Secretary, because what we have been hearing now is a lot of meltdowns, slowdowns, and statements about closing, and everything else, whereas the truth of the matter is that when you come to the infrastructure, there is no risk at Savannah River with the fuel fabrication plants that prepare the fuel there. That is not a risk factor, that is an advantage of infrastructure, is it not?

Mr. Salgado. That is an advantage of infrastructure if a heavy water reactor is chosen; that is correct.

Senator Hollings. The reprocessing plants at Savannah River, the two large-scale plants there, theyare also an advantage and not a risk.

Mr. Salgado. That is correct.

Senator Hollings. The full set of waste tanks for storage that is also not a risk, but rather an advantage that we have at Savannah River; isn't that correct?

Mr. SALGADO. That is correct.

Senator HOLLINGS. The defense waste processing facility, the waste solidification plant, that, too, is not a risk, that is an advantage that we have at Savannah River; is that correct?

Mr. SALGADO. Yes, Senator.

Senator HOLLINGS. The tritium processing facility that, too, is an advantage and not a risk at Savannah River.

Mr. SALGADO. Yes, sir.

Senator HOLLINGS. Plus the experienced personnel; isn't that correct?

Mr. SALGADO. Yes.

Senator HOLLINGS. Mr. Schoettler, that is why the ERAB report recommended Savannah River; isn't that correct?

Mr. SCHOETTLER. That is part of it, Senator. The other aspect of it was the target technology that existed for the HWR.

Senator HOLLINGS. That is what I wanted to get clear because, as I understood the Secretary's initial statement, we are at a critical stage. In 1985 we had five reactors, and we are now down in 3 years to one and one-half reactors. We have heard the testimony that we hope to get a third one producing tritium by the end of the year, but that will only have a marginal supply reliability, and we certainly need another one immediately as I understand it; isn't that correct?

Mr. SALGADO. We need more reactor capacity. Whether it is one or more, we need more reactor capacity.

Senator HOLLINGS. With respect to the matter of the C Reactor, the fact that it developed a flaw, is not in any way connected with the fact that it was at Savannah River; is that right?

Mr. SALGADO. No, sir; it did with an engineering design. I would like to try to clarify the C Reactor, if I could, because that was not a safety issue; I believe it was a design problem.

Senator HOLLINGS. My main interest and point here is that you can put different designs at Savannah River.

Mr. SALGADO. Agreed; yes, sir.

Senator HOLLINGS. In fact, you can put the high-temperature gas-cooled reactor there, and you would have some advantage, of course, again of experienced personnel and some of the infrastructure.

Senator MCCLURE. Would my colleague yield on that point, because I think the point he has just made is essential to understand, and that is that that infrastructure at Savannah River is usable and has advantages regardless of the technology chosen; is that correct?

Mr. SALGADO. That is correct, sir.

Senator HOLLINGS. I am glad my point is made, because I think that you could have the two of them. You can try both of them right there at Savannah River right now with the personnel we have. Then if you have a third one, you can go up to Hanford, but I don't know if the chamber of commerce up there would favor it.

One Senator says "Yes" and one Senator says "No," that is the reason that I made the comment.

Senator McClure. They are not speaking for the chamber of commerce in Hanford.

Senator Hollings. If we had a fourth one, we could put it in Idaho. [Laughter.]

I can't find the word "Idaho" in the National Academy of Sciences report, the Glennan report, or the Schoettler report, but I do find Savannah River, and I do appreciate that very much. Thank you a lot.

Senator McClure. I would also stipulate, if the C Reactor had been built in Idaho Falls, it probably would have developed the same fault.

TIME SCHEDULES FOR HWR AND HTGR TECHNOLOGIES

Senator Johnston. Mr. Schoettler, could you tell me, I may be missing something here. As I read the report, and as I hear you testify, the heavy water and HTGR technologies are about the same in time schedule; is that right?

Mr. Schoettler. Yes. I don't think that we collected time schedules closely enough, Mr. Chairman, to really discriminate between the two of them in terms of overall time. I think that we did make the finding that the HWR, since it has the target technology and has been in use for 34 years, maybe a total of 130 reactor years, that that was an advantage that the HWR had if the judgment was made that we needed tritium production capacity just as soon as possible. I think the finding that we had was that the HWR and perhaps the WNP–1 were the two tracks that would yield tritium production in the quickest timeframe.

Senator Johnston. Say that again, please?

Mr. Schoettler. I think we made the finding that the HWR and/or the WNP–1, the light water reactor at Hanford, the uncompleted light water reactor, that one or the other of those perhaps had the most assurance of going into tritium production somewhat more quickly than the other technologies, but within the timeframe, say, of 10 years, with sufficient R&D, any of the technologies could provide goal quantities of tritium production.

STATUS OF HTGR TECHNOLOGY

Senator Johnston. There may or may not be a time advantage for heavy water over the HTGR, but in any event you would feel confident of the HTGR meeting your 10-year time requirement; is that fair?

Mr. Schoettler. I am not sure. I think that the reason that the statement was put into the ERAB report about HWR is that it is an existing technology that has had 34 years of operating experience, maybe 130 cumulative years, and the target technology exists.

It was the opinion of the engineers, the nuclear engineers on the panel and on the Advisory Board, that if you had a technology that was in existence, that had been in production, it was easier to, perhaps, upgrade that technology to an advanced HWR to reach goal quantities of tritium than it was to take a new technology, essentially on paper, although it had a great deal of research, and build a new reactor, and finish the qualification testing, perhaps, necessary for the HTGR target technology.

Senator JOHNSTON. It says here with respect to HWR, that HWR lags the other technologies in experience with current safety and environmental review processes, and investigations of severe accident phenomenon, there is some risk of significant delays.

Mr. SCHOETTLER. That is correct.

Senator JOHNSTON. That is a risk with HWR over HTGR. HTGR does not have that disadvantage.

Mr. SCHOETTLER. That is correct; the Advisory Board looked at that. There were two main areas that we looked at in terms of what those risks are for these technologies: one area was the reactor technology and the target technology, and the other area was the safety and environmental review process.

In that particular area, it was the judgment of ERAB that the HTGR, and the review process for the reactor itself, was ahead of where the HWR is right now. The balance of that, in a sense, was that the certification of the total safety review process for the HTGR could not be completed until the tritium target technology has been developed and has reached production levels. That is not the case with the heavy water reactor at Savannah River. The target technology is already developed.

So there were two aspects for the NPR that we looked at, and the conclusion was that, perhaps, the faster track—and we didn't put a quantified time on it—would be the HWR or the WNP–1.

Senator JOHNSTON. Would this be fair to say, that the probability is that HWR would be somewhat faster than HTGR, although both would be within the 10-year timeframe as a probability; there is a possibility that HWR would be significantly delayed by safety and environmental problems, a risk which is not inherent in HTGR; is that fair?

Mr. SCHOETTLER. Yes, sir; the possibility exists for delay for safety reasons.

Senator JOHNSTON. Significant delay?

Mr. SCHOETTLER. That would be speculation on my part. I do not know, I am not familiar——

Senator JOHNSTON. We are talking about possibilities. Obviously, we have to speculate on all of this.

Is it fair to say that? I don't want to put words in your mouth, I just want to understand.

Mr. SCHOETTLER. Yes.

READINESS OF COMPETING TECHNOLOGIES

Senator JOHNSTON. Would you agree with that, Mr. Ahearne?

Mr. AHEARNE. Would you rephrase exactly what I am agreeing to?

Senator JOHNSTON. With respect to time, there is a probability that the HWR would be ready somewhat ahead of the HTGR, although both would probably be ready within a 10-year timeframe; that there is a possibility, however, that HWR would have significant time delays because of environmental and safety problems well beyond the 10-year period, a risk which would not be inherent in the HTGR.

Mr. AHEARNE. I will separate that into several pieces because I can only comment on one piece of it.

My committee—we have not looked at the detailed designs of the four types, so I can't speculate on the length of time, your 10-year question. The one element that I can comment on is that certainly the HTGR, the light water reactor, and the liquid metal reactor have in various forms gone through NRC reviews, and codes have been written and safety analyses done for them. As the National Academy pointed out, the HWR has not gone through that kind of review and safety analyses. Consequently, the probability of a safety review delay strictly on the reactor is greater for the heavy water.

The converse is that effects of a tritium target fuel have not been analyzed for any of the other three types. The input of that on the behavior of the codes. new code calculations, is some area of delay, Senator.

Senator JOHNSTON. With respect to time, is there a significant difference between HWR and HTGR?

Mr. AHEARNE. Yes; just in layman's terms. Senator, I just can't answer. The construction time, the design time, I have not looked at that. All I can say is that it is certainly going to take an additional time than for the others to validate codes and go through code development and analysis development for the heavy water reactor.

Mr. SCHOETTLER. If I could just add. There was an observation by the Advisory Board that the building of the system for the first time in HTGR for NPR perhaps will lead to design and technology problems which could also have the possibility of delaying its safety review process. I think that was a factor that the Advisory Board looked at and contrasted the maturity of that technology from an experience factor as compared to the HWR.

Senator JOHNSTON. I am just reading from your strengths and weaknesses table of the report. Both can be done relatively safely although safety would probably favor the HTGR. Am I correct on that?

Mr. AHEARNE. Safety itself would have to be a result of having gone through all the reviews. As the Board pointed out, none of these systems have gone through the detailed reviews which would lead you to conclude where safety would come out. The big advantage of three of the designs is that the codes have already been, to a large extent, developed and verified.

COST COMPARISONS

Senator JOHNSTON. Tell me about the costs because cost seems to be a problem here. Could you compare the costs?

Mr. SCHOETTLER. Mr. Chairman, the cost figures, due to the amount of time we had to do this study, were taken from the proponents, and the project definition has really not been completed by DOE. On the types of individual reactors that were proposed, the cost figures vary very widely. In the Energy Research Advisory Board's analyses in consideration there is such wide variations that there was no comparison.

I was going to say that the greatest uncertainty, perhaps, was the amount of time that it would take to build and get into production of NPR just because of the uncertainties in safety review and technology that we are faced with. The other aspect was costs, and I think the construction costs were, perhaps, $2 billion, and all of the reactors fall into that category. Research and development might be anywhere from $100 to $500 million.

Senator JOHNSTON. Do you have an opinion as to which one would cost the most? Can you give us an opinion?

Mr. SCHOETTLER. No, I can't.

Senator JOHNSTON. Can you, Mr. Ahearne?

Mr. AHEARNE. No.

Senator JOHNSTON. Can anybody tell me? In other words, the cost is not a consideration in choosing one or the other. If we had to choose today, and you tried to add all the factors, would cost be a consideration, or you just don't know?

Mr. SALGADO. I think the cost in our ballpark analysis is not a discriminator.

Senator JOHNSTON. What is the discriminator here?

Mr. SALGADO. I think the discriminator here is the reasonable assurance that we are going to be able to produce tritium for a given period of time, not for 2 or 3 years, but for 10 or 15 years from the facility we build. We have to have that kind of assurance because that is a commitment that we have to make to this country from the DOE standpoint, that there is an assured supply of tritium, either needed or have that capability not only from 1998 on, but for another 10 or 20 years beyond that, and that is the driving force, that we have the ability to maintain our nuclear deterrent if so needed.

Senator JOHNSTON. Obviously, the production of tritium between now and 1998 is not going to depend onthis new reactor. It is going to depend on the aging reactors over there at Savannah River.

If we were to make a choice right here today on which kind of reactor we were going to go to, you would say that cost is no discriminator, time is no discriminator, as I have gathered here, the discriminator is the assurance of the supply of tritium beginning roughly from 1998 on.

Mr. SALGADO. I think there are so many assets and liabilities to each technology that I think the real issue that it boils down to, when the Secretary has to make a decision, is the confidence level to be able to produce the quantities of tritium that are needed for the national security of this country either through one reactor or two reactors. I think that is basically what the driving force in the decisionmaking process has to be.

TECHNOLOGY RELIABILITY

Senator JOHNSTON. Do you have an opinion as to which one is the more reliable?

Mr. SALGADO. More reliable?

Senator JOHNSTON. Which is the better choice?

Mr. SALGADO. The program has brought forth a proposal that has been discussed both in the interagency activity as to what their belief is. Do I have it? No. In fact, I have not had the full benefit of all the in-depth consultations that have taken place between all the various components.

Senator JOHNSTON. Mr. Schoettler, what would your advice be, or do you have any advice?

Mr. SCHOETTLER. I am not in a position, Mr. Chairman, to give advice on the selection of a particular technology. What the Department and Secretary asked us to do was to evaluate those technologies, and that was just one aspect of it. There was also site evaluation.

There are national security interests in the amount of goal quantities of tritium, and all of those factors and issues determine what final choice will be made for the technology. We were just solely involved and specifically removed from the site evaluation team efforts.

Senator JOHNSTON. Does anyone else on the panel have any advice different from that?

Dr. Duncan?

Mr. Ahearne.

Mr. AHEARNE. No.

PASSIVELY SAFE REACTOR

Senator JOHNSTON. Dr. Graham?

Let me tell you where my thinking is, and I have a lot more to learn as I am sure the committee does, and that is, we need what I would call a passively safe, and what others would call inherently safe, reactor because we are going to need nuclear energy. We have global warming, we have all of those problems.

We are going to spend some billions of dollars on a defense reactor, and we have the possibility of developing a technology along with that which will serve that civilian use. We don't have enough money to build both, apparently, we don't.

So if there is a relative equality in the two—some have pluses here and some have minuses there, but if there is no clear choice on safety, schedule, all of that, why in the world not go with the one that is passively safe. It seems very clear to me, at least.

Mr. SALGADO. Mr. Chairman, that is what is under review right now, and those are the considerations. There have been numerous discussions on the benefit to the commercial and the future of the country on the commercial energy side as well as that. That is currently what is ongoing now and the dialogues that are taking place.

There is a whole series of parameters and a series of options that we are looking at. But that is the dialogue; you are absolutely correct.

Mr. WADE. Mr. Chairman, we have looked at 14 options. We have taken, as part of the internal process, Mr. Schoettler's report, the site report, the cost report, and we are now adding to that input from our consultations in the past week or so with Dr. Graham's office, with Dr. Duncan's office, and others, and we have come up with a matrix of 14 options which include single reactors, multiple reactors, different technologies at different sites. We are winnowing those down, measuring those 14 against all of the input to the point where later on this week we will make a recommendation to Mr. Salgado. We are reviewing precisely the things that you have mentioned.

Senator JOHNSTON. I know you are doing that thoroughly and well, and as it should be done. I don't mean to try to oversimplify the process. As Mencken said, "For complicated problems there is a simple solution that is always wrong." I don't want, out of simplicity, to try to reach the wrong conclusion, but it seems to me that it is a rather simple conclusion that we need an inherently safe reactor, or a passively safe reactor, I think some would insist on saying.

That is not necessarily because present reactors are not safe enough, it is because they are perceived to be not safe enough, which leads to regulatory problems and costs, and makes them uneconomical now, whereas if we had one that we could reassure people that they are actually passively safe, we have hours of reaction time instead of seconds, that would be a marvelous benefit for the country.

Is the greenhouse effect real? All of the scientists have told us that it is absolutely real. They say that the chances of it being real are 99 to 1; that is, the weather patterns we have seen, the global warming which is measurable, the chances of that happening by happenstance are 99 to 1 over it being attributable to global warming. If that is so, we ought to go to nuclear energy at least as part of the mix, and this is a way to do it.

COMMUNICATIONS FROM SENATOR THURMOND AND SENATOR NUNN

Before turning things over to Senator McClure for his final questions, I have received letters from Senator Thurmond and Senator Nunn, their views on this important topic.

So, without objection, I will put those in the record at this point.

[The letters follow:]

LETTER FROM SENATOR STROM THURMOND

July 25, 1988

Honorable J. Bennett Johnston, Chairman
Appropriations Subcommittee on Energy and Water Development
United States Senate
Washington, DC 20510

PERSONAL ATTENTION AND HAND DELIVERED

Dear Bennett:

It is my understanding that the Appropriations Subcommittee on Energy and Water Development is holding a hearing on Tuesday, July 26, 1988, to discuss the recently published report of the Energy Research Advisory Board (ERAB), Assessment of Candidate Reactor Technologies for the New Production Reactor.

I have reviewed this study and feel that the ERAB panel has thoroughly assessed this important issue. The report outlined three major points which I feel are especially pertinent to your discussion today:

1. An urgent need exists for a New Production Reactor (NPR) and a secure source of tritium.
2. The Savannah River Plant (SRP) is the most logical site for the NPR due to its existing facilities, personnel and experience.
3. Not only is SRP the best suited site, but also SRP is the most cost-effective site, as it would save $400 to $700 million to build the NPR at SRP rather than the other considered sites.

Beginning construction of the NPR as quickly as possible is important to America's national security interests, and I commend you for holding further discussions on the ERAB study. I would appreciate it if the points I have made could be stressed and the many advantages of SRP emphasized during the course of your deliberation.

With kindest regards and best wishes,

Sincerely,

Strom

Strom Thurmond

LETTER FROM SENATOR SAM NUNN

July 25, 1988

Honorable J. Bennett Johnston, Chairman
Appropriations Subcommittee on Energy and Water Development
United States SEnate
Washington, DC 20510

PERSONAL ATTENTION AND HAND DELIVERED

Dear Bennett:

This letter is in reference to your hearing on Tuesday, July 26, 1988, to discuss the New Production Reactor (NPR) and the report recently published by the Energy Research Advisory Board (ERAB).

The report outlined a number of major issues which are vitally important to the decision on where the NPR will be located and which technology will be utilized. Most importantly, the report indicated the following:

1. An urgent need exists for an NPR and a secure source of tritium.
2. The Heavy Water Reactor (HWR) presents the least schedule risk because of the existing facilities, personnel and experience at Savannah River.
3. The HWR offers the greatest possibility of meeting an urgent schedule, and siting an HWR at Savannah River would cost $400 to $700 million less than construction at other considered sites.

Thank you for your consideration of the points that I have stressed, and I hope you have an opportunity to make them a part of your deliberation during the hearing.

Sincerely,

Sam

Sam Nunn

Senator JOHNSTON. Senator McClure.

Senator MCCLURE. Thank you very much, Mr. Chairman, and I agree with the statement that you have just made.

I am a little puzzled by one thing that came out of the ERAB report, Mr. Schoettler, and perhaps you can enlighten me. You have indicated that the WNP-1 light water technology could, perhaps, be a winner in terms of time. At least it is one of the two leading in terms of time, and yet there is nothing that has even been done with the light water reactor target producing tritium.

If I understand you correctly, you really can't address that question until one has been built, completed, and tested, then you can deal with questions of the safety code on the target. Yet, the completion of a plant is 4 years away, so you can't even start the verification work until you have completed the plant and put a target in and operate it. Is that not correct?

Mr. SCHOETTLER. That is correct, or the target would have to be put into some civilian reactor, and that was one of the risks for that light water reactor scenario.

Senator MCCLURE. But if it isn't put into a civilian reactor and tested there, then you lose whatever possible time advantage WNP-1 would have?

Mr. SCHOETTLER. That is correct.

Senator MCCLURE. Otherwise it would be sequential rather than going on concurrently.

Mr. SCHOETTLER. Excuse me. The time advantage of the WNP-1 is that it is approximately 63-percent complete. There are various schedules of completeness, but overall the average is 63 percent. It appeared that the plant could be completed on a shorter time scale, but then, you are correct, the target technology qualification testing would have to take place within the WNP-1.

Senator MCCLURE. So it would depend upon our willingness or capacity, one or the other, or both, of being able to work the concurrent work on the target in a presently operating plant.

Mr. SCHOETTLER. That is correct.

Senator MCCLURE. I don't want to get into the uncertainties that are involved about the legality, or the legal questions surrounding WNP-1, I have lived with that for some years, and they still are unresolved.

I would also say that I don't want to get into the question of whether Senator Hatfield likes it or not, because he has already spoken for himself. I think Senator Adams has spoken for himself on that subject very forcefully. I gather that they have some idea that they would delay that process, or at least increase its hazardness. I think that that would be, perhaps, the minimum amount that I can say.

PROBABILISTIC RISK ANALYSES

Mr. Ahearne, what role do probability risk assessments have in safety analysis and licensing?

Mr. AHEARNE. At the present time the NRC does not have them as a formal part of the licensing process, but has encouraged all of the plants to go through these probabilistic risk analyses. The main thing that they do, they identify system weaknesses, vulnerabilities, where are problems that might be present that one had not expected. It has turned out to be very valuable, sufficiently valuable that most of the industry is now going forward to doing them.

Senator McCLURE. According to Department of Energy documents, HWR safety research at the Savannah River plants will take 4 years. If HWR is the chosen NPR technology, do you believe that these safety analyses should be completed before construction begins?

Mr. AHEARNE. I think that there are several types of safety analyses you are speaking about. There are analyses being done as was already mentioned by Secretary Salgado on the existing Savannah River plants, and PRA's, probabilistic risk analyses, are being done on those.

Those are safety analyses focused upon existing designs, existing plants, taking them where they are, as he mentioned, they are 30-year-old plants. Those are the kind of analyses that are going to have to be completed to give some high confidence that those plants could go up in power. Separate analyses would probably be required for a new design.

Senator McCLURE. Is that because the new design would be sufficiently different from the older?

Mr. AHEARNE. It would be different. Obviously, you can capture some of the work that has already been done, some of the work will be directly applicable, but I don't think that automatically you can assume that the work being done for the older design is going to be applicable to the new design.

Senator McCLURE. In your opinion, are light water reactor codes easily adapted for use with heavy water technology?

Mr. AHEARNE. No.

Senator McCLURE. You can't simply transfer the codes.

Mr. AHEARNE. The light water codes, it is not just the moderator which is a light water, they were really designed to handle the temperatures and the pressures, and the rest of the system fluid flow, and the type of fuel that exist in light water reactors.

The heavy water reactor is quite different, and I do not believe that it is a simple matter to take those codes and transfer them to a new reactor. One of the big issues that one has in any code work is to then validate the codes, and the more complex the code is, the harder time one has in validating; that is, to give confidence that the results of the codes are things that you want to believe.

DEFENSE DEPARTMENT CONCERNS

Senator McClure. Dr. Duncan, you have been kind of left alone down there at the end of the table. I don't want you to leave here without any questions.

We have kind of an understandable, but, nevertheless, unique relationship here. You are the customer.

Dr. Duncan. Yes.

Senator McClure. You are not the producer. So we have one government agency that is responsible for the production and another government department that sets the production requirements. You don't tell DOE how to do their business, and they don't tell you what it is you need. Is that fair to say?

Dr. Duncan. Yes; we are the sole customer for the particular subject that we are talking about here.

Senator McClure. There are historical reasons that it evolved that way, and I think they are imbedded in our public policy, and I support that public policy. I don't think that anybody is trying to change that. That relationship does work well, it has worked well, and I think it promises to continue to work well.

Dr. Duncan. We are very pleased with the relationship and it has worked well ever since World War II.

Senator McClure. I do note that in your statement, you stress that your primary concern is that, whatever they do, they come up with a plan that will give you an assured supply of your needs.

Dr. Duncan. A safe and assured supply of our primary need. Then, of course, cost effectiveness is important to us; that is, the cost of the tritium should be minimized consistent with safety and reliability of supply. That is our position. We do not involve ourselves deeply in the specifics of how they do that because that is their responsibility as a supplier to us, and seem to have lots of help with this.

Senator McClure. They have lots of advice.

In that process, obviously, as you look at those issues of safety and reliability, and assured supply, you do look at various aspects. Even though you trust them, you are looking over their shoulder, too, aren't you?

Dr. Duncan. Yes, we are.

Senator McClure. So you trust them a little.

Dr. Duncan. If they would do something that would concern us, we would tell them about it. We have a mechanism for doing this: the Nuclear Weapons Council, of which Mr. Wade and I are members, along with General Herres, the Vice Chairman of the Joint Chiefs of Staff.

Senator McClure. In that process, I know that you have received advice too, and that deals with questions of redundancy. That is not an unfamiliar term for people in the Department of Defense. We often times look at multiple suppliers, or two or more, to make certain that we have an industrial capacity to meet the needs of production. Is that also something you have looked at with respect to the materials supply?

Dr. DUNCAN. We have stated that we would like a safe and assured supply, and if they choose redundancy of sources and redundancy of technology to do that, we would give that serious consideration as the right way to do it.

Senator MCCLURE. I noted that statement on page 3 of your statement. Obviously, I welcome that because that is my major concern. I really am concerned that those who want us to build one reactor, with 100 percent of the supply at one reactor, are flirting with disaster for the security of this nation.

I don't know how to stress it more, and I note that the ERAB panel also recommended diversity. I think that almost every study that has even been done says that we ought to have a capacity that isn't tied up in the success or failure of one facility. I stress that because to me that is the No. 1 concern that I have as we go through this.

It isn't so much the choice of technology as much as it is making certain that we have something that works, and that we don't put all of our eggs in one basket and that we don't take the risk that one may prove to have problems. The embrittlement problem on the C Reactor was, we know now, a design flaw; it was not something that we anticipated. We didn't know it 5 minutes before we discovered it, and we couldn't anticipate it.

This is why I went into a little bit earlier that had we had all four reactors with precisely the same design that developed precisely the same problem, in that same period in their life history, we would be in trouble today. I again want to reiterate what I think is your concern as well, that we don't embark upon a program that exposes our future to the hazard of that kind of an unforeseen happening. We have enough trouble designing around those that we can foresee without getting into those that we cannot.

I don't believe, Dr. Duncan, that DOD has taken a position with respect to how to achieve the reliability.

Dr. DUNCAN. We have not taken a position with respect to how to achieve it. One gets reliability in rocket systems or in weapons systems by parallelism. Sometimes this parallelism is taking place at the component level or the subsystem level and not at the total system level, and sometimes it is taken at the total system level. The thought of two separate reactors for reliability is parallelism at the total system level.

We didn't want to take a specific position as long as we had a safe and assured supply, thinking that, perhaps, the Department of Energy, in their desire to do a cost-effective effort, might come up with some way of getting that reliability where the parallelism takes place in subsystems, or whatever.

We are quite concerned, and it is very necessary that we have a safe and assured supply.

Senator MCCLURE. Are you in a position to say whether or not you see any disadvantage in having half of your suply come from one reactor and half from another?

Dr. DUNCAN. I see no disadvantage in having half come from one and half come from another unless it runs up the cost of the tritium itself to a very high level.

Senator MCCLURE. To a very high level?

Dr. DUNCAN. Yes.

Senator MCCLURE. I would assume, and I think the preliminary cost figures, and they are simply that, are that it will cost modestly more to build two reactors at two sites, whether or not they are the same technologies, but that that increased cost is marginal. A marginal cost increase would not be something that DOD would object to?

Dr. DUNCAN. No, we don't. I would say that we would prefer a marginally higher cost for the product if we were assured always that we would get it than to have the lowest cost product and then all of a sudden not have it.

DETAILED REACTOR DESIGN

Senator MCCLURE. Mr. Ahearne, you made a comment a while ago, which I think requires at least some further comment. You suggested that you had not reviewed detailed designs in making any comment with respect to safety. I think that it is also safe to say that ERAB didn't either, because there isn't detailed design on any of these plants, with the possible exception of HTGR and the possible exception of a commercial light water reactor in which detailed design is available.

Isn't that correct; there is not a detailed design of a new HWR?

Mr. AHEARNE. That is correct.

Senator MCCLURE. There is not a detailed design of a liquid metal reactor.

Mr. AHEARNE. I am not certain, but I don't believe so.

Senator MCCLURE. You are not the only one who didn't have the opportunity to make a review of detailed design.

Dr. Graham, the National Academy of Sciences report on DOE's production reactors concluded that the existing level of understanding of severe accident behavior for the production reactors is inadequate to permit a realistic assessment of these designs to mitigate the consequences of severe accidents. Are you aware if this situation has changed?

Mr. GRAHAM. Since Secretary Herrington requested that study, Senator McClure, and since it was submitted to him, I know the Department of Energy has put into place a substantial program to address just those issues, and they have that program underway today. Department of Energy representatives could give you a more precise status than I could, but as I understand it, it will continue for at least the next 3 years.

CLASS IX ACCIDENT

Senator MCCLURE. In particular, do you know if the Savannah River safety experts have resolved the issue of recriticality with a class IX accident?

Mr. GRAHAM. I don't know the answer to that, Senator.

Senator McCLURE. I think I asked the Secretary that question earlier in a slightly different form, and if I understood correctly, he was going to supply the answer for the record.

Mr. SALGADO. Yes, we will, Senator.

Senator McCLURE. I am sorry that Senator Hollings had a 12 o'clock appointment and had to leave because I wanted to assure him that I raised the question of the class IX accident not to indicate that I think that the Savannah River reactors are operating unsafely today, but to indicate that a heavy water reactor to be constructed in the future, with a new design to new standards, is going to have to meet that kind of a test, and can't be built and operated until it does; isn't that correct?

Wouldn't that be your view, Mr. Ahearne?

Mr. AHEARNE. Senator, I certainly believe that any of the new reactors have to go through a sound safety review. A class IX accident is a term of art that has been used for years in the NRC. In many places what it means by definition is beyond the basis on which the design was made. In a way there is a tautology there that says if you are considering class IX then you are already analyzing something for which the system wasn't designed. I don't want to step into that area. I would agree that one has to go through detailed safety analyses.

POWER GENERATION FROM NPR

Senator McCLURE. Dr. Graham, the ERAB report seems to indicate that electricity sales are not of major consequence. I think I state that correctly.

Mr. Schoettler, if I state it wrong, I would invite your intervention, but that is the way I read the ERAB report.

It seems to me that that ignored projections of the need for at least 110 gigawatts of additional electrical power in the United States by the year 2000, and the growing concerns about global warming and acid rain, and the political volatility, which I hope we haven't forgotten, in the Middle East. As Science Advisor to the President, do you think the decisions on the NPR technology should, to the extent possible, factor in concerns about energy policy?

Mr. GRAHAM. Senator McClure, along with my colleagues testifying before you, I believe that the reliability of the tritium supply is the paramount issue before the country, and that should be given the principal focus. To the degree that that can be satisfactorily addressed, then I believe other concerns can also be considered, including the national energy policy and technical transfer issues.

Senator McCLURE. Some concern has been expressed that if steam were produced and sold from an NPR, that those arrangements for sale might interfere with plant operation with respect to the production of tritium. Do you see any inherent unresolvable conflict in that regard?

Mr. GRAHAM. No, Senator, because I think the clear point would have to be made at the outset of any such sale of steam, that the production of tritium was the paramount priority, and it would take precedence over the production of electricity.

Having said that, as I read the ERAB report, they mention that both the preparation for the construction and generation of steam would affect the ultimate price that the government might receive for that steam and that the way in which the reactor or reactors were divided in terms of number and power levels might also affect the price that was obtained for the steam. They point out, I believe quite rightly, that that price can vary substantially depending upon the specific arrangements and configurations that are finally determined by the Secretary of Energy.

Senator McClure. Mr. Schoettler.

Mr. Schoettler. Senator, the expression that you used was not of major consequence, and I don't think that it quite accurately reflects the discussion of the findings that ERAB made. As Dr. Graham just testified, the range of revenue varied all the way from 15 to 60 mils per kilowatt-hour.

I think the one observation that ERAB did make was that they would prefer to input steam over the fence or at the site boundary rather than to get involved in electrical generation because you get involved in NRC and regulatory agencies, and that aspect of it, an NPR, perhaps, would be the one that would be subjected to most difficulties.

The actual revenue would be site dependent, and it would be dependent upon the increased demand for the area, and also the assurance and reliability that a utility customer could expect, and that is usually for a baseload planned at least 10 years in advance. So there are a number of variations.

The other thought was that if you used it for tritium supply and at some time in the future, because of disarmament, you no longer need tritium, then there was an advantage to have some other purpose for an investment of that size.

Senator McClure. I appreciate the response, and at the risk of sounding like I am speaking for the Idaho Falls Chamber of Commerce—and I sometimes do—I would just note for the record the uncertainty of steam sales is not necessarily so great because Idaho Power Co. has a standing commitment to purchase any such output that might occur if the construction of any plant produced steam at an Idaho site.

I mention that not because I am suggesting that the only place to build it is Idaho, I don't make that suggestion. But I do want to make the suggestion that, indeed, I will bet you that you will see the South Carolina interests purchase steam if it were necessary to keep Idaho from getting the plant. [Laughter.]

I think that Idaho Power's commitment is valid at almost any location, because it will drive others to make equal commitments if for no other reason.

I can't help but read into the record something that has not been specifically referred to from the ERAB report on page 34, and it is the final line in the options conclusions. It says:

> The Board believes that a combination of technologies, including advanced technologies, offers a unique opportunity that should be carefully considered even at increased costs for a step increase in reactor safety and substantial improvement in commercial reactor technology.

That is not a bad place to leave the discussion.

Mr. Secretary.

Mr. SALGADO. I would just like to add, in case it hasn't been done, I would ask, since we made numerous references to it, that the ERAB report itself be incorporated into the report as a point of reference.

Senator McCLURE. Without objection, it will be done.

[The report follows:]

ASSESSMENT OF CANDIDATE REACTOR TECHNOLOGIES FOR THE NEW PRODUCTION REACTOR

JULY 1988

A REPORT OF THE ENERGY RESEARCH ADVISORY BOARD TO THE U.S. DEPARTMENT OF ENERGY

Energy Research Advisory Board
to the
United States Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585
(202) 586-5444

June 27, 1988

The Honorable John S. Herrington
Secretary of Energy
Washington, DC 20585

Dear Mr. Secretary:

In response to your letter of January 7, 1988, the Energy Research Advisory Board has assessed four reactor types as candidate technologies for New Production Reactor (NPR) capacity. The results of the assessment are given in the attached report.

The Board has focused its attention on the production of nuclear materials, especially tritium, as the primary mission of the NPR, as indicated in your letter. In its assessment, the Board emphasized the primary and equal importance of producing goal quantities of tritium when needed and doing so in a safe and environmentally sound manner.

The Board reviewed and modified the Department's proposed selection criteria, and reported these results to you in an Interim Report on March 1, 1988. The Interim Report is included as Appendix E of the present report. The modified criteria have been used by the ERAB in the assessment.

The report notes that the cost of the NPR program and the national defense need for the tritium product requires strong assurance of tritium production capability. The ERAB evaluation has found that the heavy water reactor has the most mature technology for tritium production at the present time, but that each of the technologies could provide new production capacity with varying degrees of risk as to cost and schedule.

The report further states that multiple reactors - either of the same type located at one site, or with different technologies and located at different sites - offer tritium production flexibility and increased production assurance. The Board has recognized, however, that deployment of multiple reactors would increase the cost. In any case, the development of new tritium target technologies would provide expanded options for future consideration. The ERAB's position is that the primary justification for using two technologies is for increased flexibility and assurance of tritium production.

There are other advantages of using different technologies, separate from those associated with tritium production. Deployment of two technologies would necessarily include at least one of the "high temperature" reactors and, therefore, would be capable of generating steam or electric power. The revenue gained by the sale of steam for power applications (the ERAB prefers the sale of steam to the sale of electricity) would provide revenue to offset NPR cost. In addition, and very importantly, development of a high temperature technology would provide both real and perceived improvements in the safety of commercial power.

I hope you will find the report responsive to the charge letter and useful. I would be happy to discuss the report with you at your earliest convenience.

Sincerely,

John H. Schoettler

John H. Schoettler
Chairman
Energy Research Advisory Board

Energy Research Advisory Board
to the
United States Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585
(202) 586-5444

July 1, 1988

Mr. John H. Schoettler, Chairman
Energy Research Advisory Board
Department of Energy
1000 Independence Ave., SW
Washington, DC 20585

Dear Mr. Schoettler:

I am pleased to forward to you the ERAB report "Assessment of Candidate Reactor Technologies for the New Production Reactor." The report reviews four reactor technologies, as requested by the Secretary of Energy, as well as criteria for the evaluation, and risks and benefits associated with each technology. The report includes a number of findings by the ERAB and identifies options that the Department could follow to obtain new production capacity.

The ERAB formed a Panel of 19 experts to help perform the assessment. The Panel provided technical background and current information for use by the ERAB in completing this report. The Panel includes individuals with wide experience in the management of reactor facilities, nuclear engineering, engineering of large energy systems, safety and environmental concerns, and physics. The Panel used six additional technical experts to help evaluate the technical information that was presented by proponents for each of the reactor types. The Panel divided itself into four subpanels, each concentrating on one of the four technologies. The Department of Energy provided a technical and administrative support team of DOE and contractor staff to help organize and assimilate the information.

I have been pleased with the cooperation provided by the members of the New Production Reactor (NPR) Technology Assessment Panel, the ERAB members, and the technical and administrative support staff.

Sincerely,

T. Papay

Lawrence T. Papay
Chairman
NPR Technology Assessment Panel

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JUNE 1988

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NPR TECHNOLOGY ASSESSMENT

ABSTRACT

The Energy Research Advisory Board (ERAB) has reviewed and assessed reactor technologies as candidates for new reactor capacity to produce tritium (and possibly plutonium) to meet U.S. requirements for nuclear weapons materials. In its assessment, the Board emphasized the equal and primary importance of producing goal quantities of tritium when needed and doing so in a safe and environmentally sound manner. Particular strengths and weaknesses of each technology were evaluated in six areas (Technology Base, Safety and Environmental, Schedule, Costs, Industrial Base, and Institutional Acceptance).

The ERAB evaluation has found that Heavy Water Reactor technology is the most mature technology for tritium production at the present time. Each of the technologies considered (others are the High Temperature Gas-Cooled Reactor, the Light Water Reactor, and the Liquid Metal Reactor) could meet the mission requirements for new production capacity with varying degrees of risk as to cost and schedule. Use of multiple reactors to provide the capacity, possibly with diverse technologies and located at different sites, would provide high production assurance, reduce uncertainties in the schedule, and minimize the risk to national security, but at increased cost. Deployment of a single reactor is the lowest cost approach but carries the operational risk of unexpected loss of all capacity for an extended period. The Board found that, with early planning, there is an opportunity to gain revenues to offset costs by the sale of steam at the site boundary for power production.

Safety is a primary consideration in the design, construction, and operation of the new reactor capacity and is of major importance to the technology selection. The Board believes that the design should take full advantage of the results of safety research to date, and that proposed safety goals and a sound safety review process will provide a level of safety that is at least equivalent to that of the best of current commercial power plants. Moreover, the advanced reactors (High Temperature Gas-Cooled Reactor, Liquid Metal Reactor, and such concepts as a small advanced Light Water Reactor) provide an opportunity for a potentially significant advancement in the level of safety over current commercial reactor experience.

EXECUTIVE SUMMARY

The Energy Research Advisory Board (ERAB) has reviewed and assessed the Heavy Water Reactor (HWR), the High Temperature Gas-Cooled Reactor (HTGR), the Light Water Reactor (LWR), and the Liquid Metal Reactor (LMR) as candidates for New Production Reactor (NPR) capacity, as requested by the Secretary of Energy in his letter of January 7, 1988. A subsequent letter of April 28, 1988 requested that duality issues (use of two or more reactors for tritium production), diversity of reactor technologies, and more than one site be included in the assessment.

The ERAB reviewed the Department's proposed selection criteria for use in evaluation of the four candidate NPR technologies. For the most part, the ERAB accepted the criteria as a suitable basis for evaluation of the NPR technology. The six criteria areas are:

- Technology Base
- Safety and Environment
- Schedule
- Costs

- Industrial Base
- Institutional Acceptability

The Board emphasized the equal and primary importance of producing goal quantities of tritium when needed (Technology Base) and doing so in a safe and environmentally sound manner (Safety and Environment). The Board also identified public acceptance as an important part of the institutional acceptability criterion.

The ERAB recognizes the potential national security risks associated with interruptions of the Nation's tritium supply, and the need for the highest possible technical excellence and national confidence in assuring the future supply of tritium. New production capacity can be obtained only with public support, high confidence in public safety, and the availability of excellent technology.

Safety is a primary consideration in the design, construction, and operation of the NPR and is of major importance to the NPR technology selection. The Board believes that the design features of the NPR should take full advantage of the results of reactor safety research to date, and that management procedures should be established with disciplined lines of responsibility, accountability, and authority.

Technical Evaluation

The ERAB reviewed and assessed the candidate technologies according to the foregoing criteria based upon U.S. experience with each technology over the past 35 years and on design concepts presented to the Board for this evaluation. The design concepts and background information presented by proponents of each technology have, generally, been adapted to this application from commercial power reactor studies or from ongoing reactor program activities supported by government or industry. The NPR project has not yet been fully defined and there have not been compatible conceptual designs for an NPR based on the candidate technologies. As such, the design proposals and technology development programs presented to the ERAB have not been consistent as to their state of development, maturity, missions, and characteristics. Therefore, the ERAB has focused on the capabilities and potential of the underlying technologies for the different types of reactors rather than current technology and specific designs.

Particular strengths and weaknesses of each technology are shown in the Table at the end of the Executive Summary. The technical evaluation by the ERAB can be summarized as follows:

- Each of the reactor types considered can meet the mission requirements of a NPR with varying degrees of risk as to cost and schedule.

- The Heavy Water Reactor has the most mature U.S. technology for tritium production at the present time. The other reactor types require varying degrees of research, development, and qualification testing of the lithium target technology to make tritium, with the High Temperature Gas-Cooled Reactor target technology being the most advanced. The LWR has the most mature and widely used reactor technology for power production.

- With proper design and a sound safety review process, each of the technologies can provide a NPR with a level of safety that is at least equivalent to that of the best of present commercial power plants. Radiation exposures to people, both on-site and off-site, are expected to be less than current practice. The advanced reactors (High Temperature Gas-Cooled Reactor, Liquid Metal Reactor, and such concepts as a small advanced LWR) provide an opportunity for a potentially significant advancement in the level of safety over current commercial reactor experience.

- The HWR presents the least schedule risk because of the existing facilities, personnel, and experience at Savannah River. Given at least ten years to achieve full production status, all candidates could meet the schedule.

- A HWR, being a low temperature reactor with no production of steam or electricity, would have the lowest initial cost of any new NPR. The other technologies offer the possibility of revenues from energy sales that, in some circumstances, could offset a significant fraction of the NPR costs.

- Conversion of the WNP-1 reactor, a partially completed commercial power reactor on the DOE site at Hanford, to nuclear materials production is a special case of the LWR technology. It offers the possibility of a shorter schedule and lower initial cost than a new NPR. Safety and environmental aspects would be comparable to those of present commercial LWRs. Target development similar to the LWR is required for the WNP-1, and the cost and time required to obtain public acceptance of conversion of a "commercial" reactor and to implement legal processes to acquire the reactor are uncertain.

Duality and Energy Sale

The cost of the NPR program and the national defense need for the tritium product (and possibly plutonium) require strong assurance that the reactor will perform as specified. Factors considered here are redundancy and diversity of production facilities (duality), and the effects of power production by the NPR.

- Multiple smaller reactors of the same type offer advantages of protection against loss of all capacity, flexibility, and increased potential for the use of passive safety features, but at some added cost. This approach should be considered for all technologies.

- A multiple reactor strategy, possibly with diverse technologies, would provide high production assurance, reduce uncertainties in the NPR schedule, and minimize the technical risks to national security, but at increased cost. A single unit NPR is the lowest cost option, but carries the operational risk of unexpected loss of all capacity for an extended period. If a single-technology option were selected, it would be prudent to develop or qualify target technologies for other reactor types to provide for future contingencies.

- With early planning, there is an opportunity to gain revenues to offset costs by the sale of steam at the site boundary for power production.

Urgency of the Schedule

The ERAB is convinced that it is urgent for DOE to begin the long process to acquire new production capacity. There are several factors that affect the schedule:

- Each of the technologies can be utilized for a NPR with further preparation. The needed preparation differs in each case and may include research, development, or qualification of part of the technology, and it will include analysis and testing to provide data for a safety review and approval process.

- DOE, in consultation with its independent safety overview bodies, should establish the review process for the NPR project without delay. The DOE should provide adequate qualified personnel and budget.

- A strong management organization with authority and accountability for all aspects of the NPR program is necessary to achieve the schedule.

- Successful development, design, construction, and startup of a NPR requires a continued commitment from both the Executive Branch and the Congress over many years.

- DOE should seek an expedited schedule for acquisition of the NPR, including legislative relief from existing constraints where needed.

Options

If there is a need for full tritium production as early as possible, then options are limited to the HWR and WNP-1 conversion. The HWR appears to have the best chance of quickly providing the needed capacity because of the existing facilities, personnel, and experience at Savannah River. The ERAB recognizes that the WNP-1 may provide a unique opportunity for conversion to tritium production at relatively low capital cost while providing some revenues from the sale of steam. However, there are schedule risks because of the need to demonstrate an adequate target technology, uncertainties of public acceptance of conversion to defense purposes, and possible delays because of the legal processes required to acquire the WNP-1 facility.

If new production capacity to provide goal quantities of tritium can be phased into operation over a time period beginning in about ten years, then additional opportunities are presented. The Board believes that a combination of technologies, including advanced technologies, offers a unique opportunity that should be carefully considered, even at increased costs, for a step increase in reactor safety and a substantial improvement in commercial reactor technology.

STRENGTHS AND WEAKNESSES TABLE

H W R TECHNOLOGY

STRENGTHS	WEAKNESSES
The tritium and plutonium production technology, fuel cycle facilities, waste system, and operational support infrastructure are fully developed and in production at Savannah River and have generally operated well. This is a major strength.	The HWR lags the other technologies in experience with current safety and environmental review processes and in investigations of severe accident phenomena. There is some risk of significant delays.
The low temperature and pressure operation simplifies the reactor engineering. Greater use of passive decay heat removal is possible than in current Savannah River Reactors.	Technical issues raised by the 1987 National Research Council report on production reactors must be resolved and have been addressed in the proposed NPR designs.
The preoperational and capital costs of a HWR facility sited at Savannah River are substantially less than those of other new NPR options because auxiliary facilities are already in place.	There are no revenues from the sale of energy.
There is good confidence in the construction schedule and moderate confidence in the cost estimates based on HWR and relevant LWR experience, and on tritium production experience.	

STRENGTHS AND WEAKNESSES TABLE (CONTINUED)

H T G R TECHNOLOGY

STRENGTHS	WEAKNESSES
The modular design provides flexibility for phased expansion and assignment of individual units to special production tasks, and could generate improved power revenues because a portion of the energy could be considered firm.	There is limited design, construction, licensing, and operating experience in the U.S. with HTGR technology. Development concerns are addressed in the proposed R&D program.
Target technology development is at an advanced stage, and could be qualified in a research reactor.	Plutonium production is feasible but not demonstrated.
Small modular units with inherent safety features, including passive decay heat removal, offer a potentially significant advancement in safety over current commercial reactors and improve the potential for successful safety review. Fuel and target microspheres provide good containment of tritium and fission products.	Preoperational and capital costs are high.

STRENGTHS AND WEAKNESSES TABLE (CONTINUED)

L W R TECHNOLOGY

STRENGTHS	WEAKNESSES
The reactor technology, fuel technology, and safety review methodology are established and well understood based on commercial power reactor applications.	The target technology has demonstrated feasibility but requires further development and qualification testing, most likely in a full-scale LWR. This would require access to a commercial reactor and reviews by the Nuclear Regulatory Commission. For the WNP-1 conversion, testing in-situ is possible after the reactor has been completed.
Commercial operating experience and experience with construction and startup schedules is extensive and varies widely. There is good confidence in the NPR construction and safety review schedule if the commercial experience is used properly.	Plutonium production would require a large and costly uranium fuel inventory.
Cost estimates are of moderate confidence based on commercial power plant experience. Most components of the proposed reactor have already been reviewed by the Nuclear Regulatory Commission.	While there is good likelihood of success, the target development entails cost and schedule risk.
There is a large industrial infrastructure supporting the LWR.	Coupling a commercial power reactor (e.g. WNP-1) or fuel cycle to a defense application, may have a negative connotation.
Conversion of WNP-1, a partially completed LWR on the Hanford site, to a production reactor is a unique and potentially low cost alternative.	The time needed to complete the legal process to acquire WNP-1 and public acceptance of conversion to tritium production are uncertain, and introduce schedule risk.

STRENGTHS AND WEAKNESSES TABLE (CONTINUED)

L M R TECHNOLOGY

STRENGTHS	WEAKNESSES
The LMR is an attractive production concept in the long term because of its excellent neutron economy, superior neutronics for high-grade plutonium production, modularity, and extensive use of passive safety features.	The target technology is at an early stage of development. Research, development, and qualification testing are required. This is a major weakness.
There is good but limited reactor operating experience. The DOE operates test LMRs that could be used to develop and qualify target technology.	A design for a NPR, optimized for tritium production, does not exist. Modular, commercial reactor conceptual designs at a higher operating temperature could be modified for this application.
The modular design provides flexibility for phased expansion and assignment of individual units to special production tasks, and could generate improved power revenues because a portion of the energy could be considered firm.	There is considerable schedule and cost uncertainty, considering the scope of target development, concept development and selection, detail design, and construction of a first-of-a-kind complex.
Small modular units with inherent safety features, including passive decay heat removal, offer a potentially significant advancement in safety over current commercial reactors. The inherent safety features have been partially demonstrated in EBR-II.	Strong industrial backing for this concept as a NPR is not apparent.

I. INTRODUCTION

Tritium is an essential element in the nuclear weapons of the United States. The element must be replenished on a regular basis as it decays with a half life of 12.36 years. Tritium has been provided for many years by the production reactors operated by the Department of Energy at its Savannah River facility in South Carolina.

The operating production reactors were built in the 1950's, and are now showing their age. A recent study by the National Research Council* stated that the production reactors all display symptoms of acute aging that could affect safety and are likely to limit the useful lives of these reactors to times equal to or shorter than the time needed to authorize, fund, design, and build new production capacity. Only two of the Savannah River reactors are now producing tritium, and these are operating at approximately half power. This reduction in the capability to produce tritium, coupled with concern about the remaining life of the reactors still operating, requires that the nation promptly begin the process of acquiring new production capacity. Accordingly, the Department of Energy, in concert with the Department of Defense and the Congress, is planning the construction of New Production Reactor (NPR) capacity.

On January 7, 1988, the Secretary of Energy asked the Energy Research Advisory Board (ERAB) to conduct a review and assessment of four nuclear reactor technologies that the Department is considering as candidates for the NPR. The letter from the Secretary to the Chairman of the ERAB requesting this assessment is reproduced as Appendix A of this report.

The Secretary requested that the ERAB review and assess:

1. The Department's proposed selection criteria for the NPR.
2. The adequacy of each of the four technologies to meet the criteria.
3. Schedule and technical risks, benefits and costs in implementing a NPR program with each technology.

A subsequent letter from the Secretary (April 28, 1988 - Appendix B) requested that duality issues (use of two or more reactors for tritium production, diversity of reactor technologies, and more than one site) be included in the assessment.

Chapter II of this report summarizes the review of the NPR selection criteria and Chapter III provides the technical evaluation. During the course of the technical evaluation, issues have emerged that have an impact on the assessment. These include the urgency of the schedule, the question of duality, and power production. Findings relative to these issues are covered in Chapter IV. Chapter V presents deployment options for consideration.

The four candidate reactor technologies that the Department is considering are:

1. The Heavy Water Reactor (HWR). The technology considered for weapons material production operates at low temperature and pressure, utilizing highly enriched uranium fuel clad in aluminum, heavy water coolant and moderator, and thermal discharge directly to cooling water. The Savannah River production reactors are of this type.

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* National Research Council, "Safety Issues at the Defense Production Reactors", National Academy Press, Washington, D.C., 1987.

2. The High Temperature Gas-Cooled Reactor (HTGR). This technology is based on a graphite moderator, highly enriched uranium fuel micro-particles coated with carbon and silicon carbide in a graphite matrix, and helium coolant. The graphite structure accommodates high coolant temperatures which provide energy to a steam power cycle. The fuel and cooling technologies and most of the components are similar to those used in the Ft. St. Vrain commercial power reactor.

3. The Light Water Reactor (LWR). This technology is based on low enrichment uranium oxide fuel clad in zircaloy and cooled and moderated by ordinary water at high temperature and pressure. The LWR technology is used widely for commercial power reactors, for which a broad industrial base and an established safety review process exists.

4. The Liquid Metal Reactor (LMR). The LMR technology proposed for the NPR utilizes highly enriched uranium metal fuel clad in stainless steel and cooled with liquid sodium. It has a highly energetic neutron spectrum since there is no moderator. The technology is similar to that being developed for power production, except for a somewhat lower operating temperature. The temperature is still high enough for power production.

These designations describe types of reactors differing in such features as coolant, moderator, fuel and target materials, operating temperature and pressure, neutron energy spectrum, and the capability to generate electric power. The available data differ for the production of strategic materials by these four types of reactors. The HWR technology has a long history of successful production of tritium. There is no operating experience for tritium production in any of the other technologies. Moreover, specific designs presented to the ERAB panel for production reactors utilizing these technologies have not been brought to a consistent basis because project definition for the NPR is not complete. Therefore, the ERAB has tried to focus on the capabilities and potential of the underlying technologies for these types of reactors rather than the current technology and specific designs.

The ERAB also looked briefly at alternatives to the four reactor technologies that have potential benefits for tritium production; specifically, accelerator systems and fusion systems. The Board concluded that these technologies are not mature enough to provide new production capacity in the next ten to twelve years.

The ERAB formed a Panel of 19 experts to help perform the assessment. The Panel has provided background and current technical information for use by the ERAB in compiling this report. The Panel included individuals with wide experience in the management of reactor facilities, nuclear engineering, engineering of large energy systems, safety and environmental concerns, and physics. The Panel used six additional technical experts to help evaluate the technical information that was presented by proponents for each of the reactor types. The Panel divided itself into four subpanels, each concentrating on one of the four technologies. At least one of the technical experts worked with each of the subpanels. A list of the meetings held by the Panel, the subpanels, and the ERAB to conduct this review is given in Appendix C. The reports by the four technology subpanels will be published separately, and are identified in Appendix D of this document.

The Department of Energy provided a technical and administrative support team of DOE and contractor staff to help organize and assimilate the information. The technical support staff worked with the subpanels and also analyzed the technologies in five areas that cut across the reactor concepts: tritium and fuel cycle technology, safety and environmental performance, required schedule and risks, costs, and engineering. Members of the technical support staff attended all the meetings and submitted lists of questions to the proponent organizations on behalf of the Panel. Some staff personnel visited the proponent organizations for discussions and review of the detailed information that supports the technology. The results of the support team and their reports on the five cross-cutting areas have provided technical information that assisted the Panel in its deliberations, and the reports are listed in Appendix D.

An Interim Letter Report was submitted to the Secretary of Energy by the ERAB on March 1, 1988, as requested by the Secretary. The Interim Report is a review of the Department's criteria for selection of the NPR technology, the first part of the charge to the Board. The Interim Report is included here as Appendix E.

II. SELECTION CRITERIA

The goal of providing new production capacity is to produce required quantities of tritium at the earliest possible date and thereafter, on an assured, sustained, safe, and environmentally and institutionally acceptable basis. The criteria recommended by the ERAB are given in the attachment to the Interim Report (Appendix E). The six top-level criteria are:

- Ability to produce goal quantities of tritium on a timely schedule. (Technology Base)
- Ability to meet safety and environmental requirements. (Safety and Environment)
- Assurance of the availability of reactor, fuel, target, and processing technology for full-scale production on an urgent schedule with low schedule risk. (Schedule)
- Ability to meet the goal in a cost effective manner. (Costs)
- Availability of personnel, material, and facilities necessary to design, develop, manufacture, construct and operate the NPR. (Industrial Base)
- Contributions to the advancement of nuclear technology, the implications of duality, public acceptance, and the impact of the sale of steam or electric power on the above criteria. (Institutional Acceptability)

For the most part, the ERAB accepted the criteria as proposed by the Department as a complete and objective basis for assessment of the candidate NPR technologies. The Board emphasized the equal and primary importance of producing goal quantities of tritium on a timely schedule and doing so in a safe and environmentally sound manner (the first and second criteria).

The Board believes that the design features of the NPR should take full advantage of the results of reactor safety research and operational experience to date, and that the safety performance of the NPR should be at least equivalent to that of the best of present commercial power reactors.

The remaining four criteria, while of lesser importance, are nonetheless significant. The third and fifth criteria are concerned with potential bottlenecks on the design, production, and operation of the NPR. To examine these issues, the ERAB identified the principal technical uncertainties regarding each of the candidate technologies, and the availability of facilities, personnel, materials, and a sufficient knowledge base to assure completion of the project in a reasonable amount of time and the project's continued production reliability once completed.

The fourth criterion, costs, required a comparison of the expected costs, and the range and sources of cost uncertainties, for each technology. In the short time available for the study, the ERAB was unable to develop cost estimates based upon a consistent costing method. Instead, the Board had to rely on information provided by the technical support cross-cut group, based on information provided by the proponents for each technology. Whereas the ERAB does not endorse the accuracy of these data, the information seems to be sufficient for estimating relative costs and cost uncertainties for each major technical option.

The sixth criterion deals with institutional issues related to the NPR decision. The Board has interpreted "contributions to the advancement of nuclear technology" broadly to include civilian and defense nuclear technology. As the only major new reactor likely to be constructed in the foreseeable future, the NPR provides the means to: improve dramatically the public perception of the safety of nuclear power; demonstrate a step increase in reactor safety by building a reactor (or reactors) that incorporates passive safety features; and prove reactor concepts that have great potential merit in the international marketplace.

The sixth criterion also includes an assessment of multiple reactor technologies and/or sites (duality). There are various possibilities for duality, including: diversity of technologies and sites; redundancy of capacity by multiple reactors of a particular type of full or lesser tritium production capability; and time-phased construction of the same or different reactor types. The Board has considered each of the candidate reactor technologies from the viewpoint of duality in its assessment. Duality is a policy issue that is discussed further in Chapter IV.

The issue of public acceptance is broadly considered. It includes public concern regarding safety and environmental issues, as well as fuel cycle concerns about nuclear weapons proliferation. For each technology, the ERAB reviewed the potential difficulties involved in resolving public perception issues related to safety and environmental concerns. The ERAB believes that the NPR technology provides the opportunity for a significant advance in safety and environmental protection.

III. TECHNICAL EVALUATION

This chapter describes the board's evaluation of the four candidate technologies, in alphabetical order, according to the selection criteria. This is followed by a comparison of the technologies on the basis of the discriminating criteria: maturity of the technology, safety and environment, and schedule and cost.

A. Heavy Water Reactor (HWR) Technology

Heavy Water Reactors have operated at the Savannah River Plant (SRP) for over 34 years and have accumulated over 130 reactor-years of operating experience. The SRP reactors have produced tritium, plutonium, and other isotopes throughout this time period but, because of their low temperature, do not produce steam or electricity. Improvements in system design have occurred aimed at increasing the efficiency and safety of reactor operations. Until the recent derating of the SRP reactors because of safety questions, and the removal from service of one reactor because of a specific aging-related failure, the reactors achieved high availability in operation with good operational safety, low personnel exposure, and efficient production.

Other experience with Heavy Water Reactor systems has been obtained world-wide. Most notably, the CANDU power reactor system has been the backbone of the highly successful Canadian nuclear power program for three decades. These reactors are cooled and moderated with heavy water, but unlike the SRP reactors, operate at high pressure and temperature, with a zirconium - uranium dioxide based fuel system. Other successful heavy water reactor experience world-wide contributes to confidence in the success of a HWR-NPR.

The Savannah River HWR experience provides an extensive data base of successful materials production performance for the design and safety review of a NPR. The HWR technology is unique in its proven capability to produce tritium and flexibility to produce plutonium and transuranic isotopes. The SRP target system is a dilute lithium-aluminum (LiAl) alloy extruded into tubes and clad with aluminum, and is the only fully proven technology for tritium production within the United States. If the HWR-NPR is sited at Savannah River, the complete fuel cycle and target facilities would be available. If an HWR-NPR were sited at Idaho or Hanford, additional capital cost of approximately $400 to 700 million is estimated for the fuel cycle and target facilities.

Three design concepts for NPRs utilizing HWR technology were presented to the ERAB by three separate industrial proponent teams. Each used the Savannah River reactor experience as the basis for the reactor and target design. In addition, the design proponents addressed the issues of aging and safety raised by the National Research Council report of 1987, such as material embrittlement and intergranular stress corrosion cracking, effectiveness of Emergency Core Cooling Systems, lack of robust containment, and the understanding of phenomena and capability for analyses of severe accidents. The design concepts provide a spectrum of features which could be included in an actual NPR design. The HWR for the NPR would include a large dry containment vessel.

The HWR technology operates at low pressure and temperature, and therefore has low stored energy. The low normal operating temperatures provide large margins to component failure. The inherent features of the low-temperature HWR, coupled with adoption of modern safety features available from LWR technology, should insure achievement of reactor safety plus environmental protection equivalent to that of the best commercial reactors. Safety analysis and R&D currently in progress is needed to respond to the issues raised in the 1987 National Research Council report. In particular, augmentation of the present understanding of severe accident phenomena, and the development and validation of methods and codes for safety review, are needed. The operating history of HWR technology, the use of relevant LWR safety technology, and successful completion of severe accident R&D programs specific to heavy water fuel and target designs, will provide assurance that safety criteria will be met.

A number of factors lead to uncertainties in the schedule for a NPR based on HWR technology. The DOE has not completed a project definition phase and key decisions remain, such as the specification of reactor power and selection of specific safety features. The HWR technology has not been subjected to a regulatory type of safety review and the technical tools for responding to a safety review are still being developed. A HWR based on the Savannah River fuel-target design could probably be carried out on a schedule consistent with production needs.

The low-temperature, low-pressure, HWR-NPR technology without power production should have low capital costs. If built at Savannah River, the capital costs are further reduced through utilization of existing fuel and target fabrication and processing technology and facilities. However, there would be no energy revenues. A NPR-HWR project will have the benefit of the years of successful operating experience and current safety research and PRA (probabilistic risk assessment) work at Savannah River. Conversely, the current SRP reactors could benefit from R&D work performed for the NPR.

The HWR-NPR Project can contribute to the advancement of nuclear technology primarily through development and testing in specific technical areas such as robotics, refueling automation, in-core instrumentation, and redundancy in safety systems. However, major contributions to overall commercial reactor system development are not expected.

While the Du Pont Corporation will not renew its contract with DOE to operate the Savannah River Plant at the end of 1988, much of the Savannah River workforce is expected to remain. A new operating contractor will be selected by DOE prior to the designation of a vendor to supply the reactor system. Many of the resources of the LWR industry are applicable to a HWR.

The three HWR design concepts presented to the ERAB are all full-size reactors capable of producing goal quantities of tritium. Reactors of smaller sizes, although not proposed, could be designed and built to support duality concepts. The fundamental design advantages of the single purpose HWR (e.g. low pressure, low temperature, and proven target technology), would be retained in a small HWR. The smaller reactor would offer safety advantages by virtue of smaller fission product inventory and lower decay heat load. Consequently, it would offer the possibility of increased margins in potential accidents and in decay heat removal system capability. Benefits in production assurance and flexibility, reactor availability, construction schedule, phased funding, and safety are likely for multiple smaller reactors, at the price of higher capital, operating, and maintenance costs, and higher schedule risk.

B. High Temperature Gas-Cooled Reactor (HTGR) Technology

The HTGR technology is represented by the Modular HTGR-NPR, (MHTGR) proposed by a joint company of proponents organized especially to develop and build this reactor. The design utilizes the modular reactor being developed under the DOE Advanced Reactor Program. Goal quantities of tritium are to be produced by two "production blocks," each consisting of four reactors with shared support and power facilities.

The reference tritium targets are "TRISO" graphite and silicon carbide coated lithium aluminate particles that are similar in design to the fuel particles currently used at the Fort St. Vrain power plant. Statistically significant numbers of reference target particles have been irradiated for times shorter than required for production, but at levels of lithium burnup and temperatures that exceed expected NPR service conditions.

The proponents proposed a target technology development program in which target compacts are formed from target particles and a thermoplastic graphitic matrix, similar to the fuels that have been used for the Peach Bottom 1 and Fort St. Vrain HTGR power reactors. Full-size target elements would be irradiated in the Advanced Test Reactor (ATR) to provide validation of the target concept. Technology projects also have been defined for core materials, fuels, target processing, components and systems, and HTGR waste forms, which are different from water-cooled reactor wastes familiar to defense programs.

The proposed modular HTGR design incorporates new safety features including passive reactor shutdown and decay heat removal, and high-temperature retention of tritium and fission products by the fuel and target particles. The proponent's design eliminates the possibility of core meltdown and indicates that public safety is enhanced by entirely passive means following an initiating event, representing an advancement in reactor safety technology. The reactors are placed in underground silos and have a below-grade pressure containment structure to enhance safety. Experience from operating HTGRs indicates that contact maintenance is possible with low occupational exposure and that releases to the environment are well below protective action guidelines.

The Peach Bottom 1 and Fort St. Vrain reactors were both licensed by the Nuclear Regulatory Commission (NRC). The Fulton and Summit large commercial HTGRs were licensed through the construction permit stage prior to being canceled. The commercial MHTGR is in the process of being reviewed by the NRC. These experiences, together with the passive safety features built into the MHTGR design, should contribute to success in the safety review process.

The HTGR proponent has presented a schedule for a fully operational NPR facility in ten years. The planned technology development activities, detailed plant design, component engineering and testing, and the safety and environmental review are scheduled for completion within the ten year schedule. According to the proponents, supporting fuel cycle facilities can be provided on a schedule consistent with that of the reactors.

The front-end costs of the HTGR-NPR, including the pre-operational costs, are estimated to be high. These costs could be partially recovered through revenues from energy sale.

The HTGR-NPR highly enriched uranium fuel is taken to high burnup; therefore incentives for reprocessing are reduced. The reprocessing option must be considered within the framework of waste disposal, total fuel cycle costs, and environmental considerations.

There is industrial capability for executing nuclear projects of NPR scale. Available test facilities would contribute significantly to the NPR program. The concept design incorporates components and testing measures that are specifically intended to avoid the operating problems experienced at Fort St. Vrain. Additional fuel cycle facilities are needed to support the HTGR-NPR and are incorporated in the program plan.

The NPR is an opportunity for a first plant based on the advanced MHTGR design that would incorporate the application of passive safety technology. The modular design provides flexibility for producing various desired weapons materials.

C. Light Water Reactor (LWR) Technology

The LWR incorporates the most mature and widely used nuclear technology for power production available today in the United States and the world. At present there are more than 100 LWR electric plants in operation in the U.S. There is also extensive naval reactor experience. However, there is no production level operating experience with LWR tritium targets.

Light Water Reactor technology has been represented in this evaluation by two reactor system concepts: the Special Water Reactor (SWR) and WNP-1. The SWR, the first concept, is based on current standardized pressurized water reactor (PWR) commercial nuclear power technology, updated and modified for tritium production purposes. Approximately 90% of the components are estimated to be identical to PWR components. The second system proposes conversion of the partially completed WNP-1 reactor to a tritium production facility. WNP-1 is a pressurized water reactor that was designed and partially constructed for the Washington Public Power Supply System on the DOE's Hanford site near Richland, Washington. The WNP-1 is discussed later in this section.

The LWR concepts evaluated in this review use conventional LWR fuel in the form of uranium oxide pellets, enriched to 8-10% in U-235. This approach utilizes a well-established low enrichment LWR fuel fabrication and irradiation experience with modest increases in enrichment (4-6%), rather than introducing a new highly enriched fuel that might be more efficient in tritium production but would require development and demonstration. These rather low enrichment fuels were selected to limit safety (recriticality) questions involving enriched fuel and to make fuel reprocessing optional. These choices appear to make it possible for the project to proceed more expeditiously using currently available fuel technology, but at the expense of reduced tritium production efficiency compared to what is available with advanced highly enriched LWR fuel cycles. Low enrichment fuels would also be used for a dedicated plutonium production mode, if desired. Plutonium production in LWRs would require optimized management of fuel and target irradiation schedules, leading either to higher fuel inventories or reduced tritium production.

The main features of power LWRs, especially the use of elevated coolant temperatures, have been retained to permit production of steam and/or electric power as a marketable by-product of the tritium production process. The lithium-bearing target rods that are inserted into the reactors to produce the tritium must therefore operate at these elevated temperatures (typically 600°F) and must retain their integrity under reactor transients. This temperature discourages the use of the low temperature (200°F range) target design and technology that has been used with great success for over 30 years in the HWR plants at Savannah River, but the use of an aluminum barrier design should not be precluded at this time.

Target development and qualification will require extensive testing for the target concepts, perhaps in a LWR. The reference design for the target rods is based on lithium aluminate contained within a stainless steel tube with a tritium diffusion barrier and getter to retain the tritium over the irradiation time of the target. Sufficient testing has been completed to prove the feasibility of the reference target materials selected for tritium production. An alternative target system was tested extensively at high temperature in the Hanford N-Reactor and may be adaptable to the LWR.

The basic chemical processes and technology for LWR fuel reprocessing have been developed on non-radioactive systems in the U.S., but no plants have been operated. Experience is available in France, Germany, and Japan. The high level waste forms and solidification processes have been demonstrated overseas and are similar to those being developed for the HWR. However, new facilities, or modifications to facilities, would have to be designed specifically for the NPR project, if reprocessing is economically justified.

The proposed design of a NPR-LWR would incorporate more extensive use of active and passive safety features than employed in currently operating commercial plants. The safety-related data base on LWRs has expanded considerably since the current plants were designed. The safety review of a LWR-NPR would appear to be facilitated because criteria for such a review are well established and the industrial proponents are experienced in preparing for the review process.

The light water technology includes extensive experience in design, licensing, equipment fabrication, construction, operation, and supporting infrastructure, which indicates that construction and review schedules can be met. Life-cycle costs are reduced by the sale of steam or electricity. A technical and schedule risk is associated with the development of high temperature targets. In particular, irradiation-testing of target elements in a LWR environment will likely be required to qualify the target technology.

About 20% of LWR projects have experienced severe delays and cost overruns, mostly since 1980. While some of these setbacks have been the result of retroactive changes in safety requirements, in most cases the difficulties were related to the quality of inspection and record-keeping. These difficulties represent a generic risk applicable to all nuclear projects. The risk of delays attributed to quality control problems can be minimized through management commitment to quality assurance practices.

The Special Water Reactor concept was also reviewed as a half-sized version, a small SWR. An advanced version of the small SWR proposes passive cooling. This could provide multiple smaller reactors for increased availability of production capability and with additional safety features. The advanced, small SWR concept has not been reviewed by the ERAB.

The WNP-1 is a unique option that may offer the possibility of a short schedule and low project cost, assuming successful target development. Construction of the WNP-1 was 63% complete[*] at the time it was suspended in 1982, and the plant has been maintained in an active preservation status since that date. All of the main structures of the reactor are complete and all of the heavy equipment that has long lead times for design and procurement, including the turbogenerators, is on site or installed. Modification of some existing components and development of target-related equipment would be required to use WNP-1 for tritium production. Safety and environmental aspects would be comparable to those of commercial LWRs.

There are several sources of uncertainty in the schedule for WNP-1. The first of these is the acquisition of title, which deserves early attention; earlier legal studies have indicated that acquisition can be accomplished at reasonable cost and in a reasonable time. Public acceptance of conversion of a civilian reactor fuel cycle to a tritium production fuel cycle is uncertain. Final qualification of WNP-1 target rods at full-size in an LWR will likely be necessary.

). Liquid Metal Reactor (LMR) Technology

The LMR is potentially a very efficient producer of tritium and high-grade plutonium, in terms of atoms per unit fission. Long-term operation of the EBR-II test reactor (Experimental Breeder Reactor-II) indicates that reliable core materials and fuel cycle operation can be achieved.

The LMR has no proven target technology or tritium target system. Essentially no target development has been initiated specifically for the LMR. Thus there is greater uncertainty in the time and cost of LMR target development than for the other technology concepts. However, a number of promising target concepts exist, based partially on tests with other coolants. In the reference system presented for the LMR, the reactor operating temperature has been reduced some 300°F from power reactor conditions to minimize target development uncertainties.

A LiAl intermetallic alloy has been identified as the reference target material for the LMR. There is some metallurgical experience with this material from the advanced battery program. The extensive HWR experience with LiAl is only partially relevant because the LMR requires a much higher lithium content in its target, and is, therefore, a mechanically different alloy. The tritium recovery phase would be similar to the HWR process, except for decladding.

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[*] Construction is 68-70% complete, procurement is 95% complete, and checkout is approximately 5% complete; the overall status of all construction-related activities is estimated at 63%.

The fast neutron spectrum of the LMR requires lithium enriched with the lithium-6 isotope, and a high lithium inventory and throughput. A once-through lithium cycle is, therefore, impractical for the LMR. Development and qualification of a lithium recycle process would be required.

A target feasibility program, including a full-scale demonstration, is needed. EBR-II and FFTF are available as test beds; however, their operating temperatures are higher than those proposed for the NPR. A true target demonstration would require dedication of one of these reactors to NPR target development so that its temperature range could be modified. Preliminary assessments indicate that such temperature reduction is feasible.

The key aspect of recent LMR program history in the U.S. is a reduced emphasis on breeding and a primary emphasis on safety and economics to make the LMR a competitive power producer in the intermediate term. Focus has been placed on innovative modular designs. These are the 1160 MWt Sodium Advanced Fast Reactor (SAFR) and the 425 MWt Power Reactor Inherently Safe Module (PRISM). Both have increased passive safety advantages relative to earlier LMR designs. The other major focus has been on the Integral Fast Reactor (IFR) fuel cycle concept utilizing metal fuel and, if desired, on-site electro-refining reprocessing and injection casting refabrication. The IFR fuel cycle appears to be well suited to the NPR and either SAFR or PRISM designs are applicable, with modifications. Goal tritium production would require two SAFR modules or six PRISM modules. These concepts are being developed under DOE's Advanced Reactor programs. A single, larger core plant design could also be used, although not proposed.

The general state of LMR technology, world-wide, is approaching commercial status. In the U.S. the EBR-II and FFTF (Fast Flux Test Facility) test reactors, both of moderate size, have operating records with high capacity factors and demonstrated safety features. Some difficulties have been experienced (world-wide) with steam generators; the lower operating temperature of the LMR/NPR would place less demand on the heat removal components than the reference power reactors. Nevertheless, extensive development, testing, and qualification work remains to design and validate a NPR version of the LMR.

The LMR-NPR concepts incorporate passive safety features, building on the safety data base acquired through development and operation of reactors in DOE's civilian reactor program. The LMR concepts, as presented, did not have large high pressure containment as an independent safety feature.

The FFTF, as a DOE facility, did not require a Nuclear Regulatory Commission (NRC) license; however, it did undergo a significant NRC review. A formal licensing process on the Clinch River Breeder Reactor was abandoned when the project was canceled just as a construction permit was about to be issued. Research offices of the NRC have interacted closely with the designers of SAFR and PRISM. These experiences, together with the LMR passive safety features, should contribute to success in the safety review process.

The costs and schedules for a LMR-NPR are uncertain as they are based on commercial conceptual designs. The plans are derived primarily from DOE's program to develop SAFR and PRISM. Much of the LMR R&D supported by the DOE is applicable to the NPR and could thus reduce preoperational costs to defense programs if these efforts are continued.

The industrial base for the LMR includes design and some manufacturing capability, but mobilization would be required. The metal-fueled IFR program is a major DOE activity and the use of its R&D facilities and personnel should be an asset to the development of the NPR-LMR fuel cycle and target facilities.

The FFTF facility at the Hanford site has been suggested as a potential contributor to NPR capability. If it were converted to low temperature operation, some additional heat rejection equipment provided, and a target technology developed and demonstrated, the FFTF could supply a small but significant fraction of the goal quantity of tritium. The time needed for the modifications and target development affect the ability of the FFTF to serve as one of the options that DOE might consider.

E. Comparison of the Candidate Technologies

Maturity of the Tritium and Reactor Technology

Assessment of the ability to achieve the tritium production mission requires evaluation of both the maturity of the tritium target technology and the reactor technology in which the target is incorporated for irradiation.

The HWR target technology is the most mature U.S. tritium production technology. It has demonstrated the capability over many years to provide weapons material reliably and predictably. The target technologies for the other candidates require varying degrees of development and qualification. The HTGR target technology has been demonstrated but must be fully qualified through testing. The LWR target must first be selected from promising alternative concepts and then carried to a qualified design through testing, preferably in an LWR environment. The LMR target technology requires conceptual design, evaluation and testing in an LMR environment.

Production of weapons-grade plutonium, though not of primary importance in selection of the NPR technology, is routine in the HWR. It is also feasible, but not demonstrated, in the other concepts. Because of the short irradiation times required in the plutonium mode in the LWR to avoid build-up of undesirable plutonium isotopes, there would be frequent interruptions to the sale of energy. As a result, the price for energy and the amount sold would both be reduced when producing plutonium. The fast spectrum of the LMR minimizes the build-up of the undesirable isotopes, so its usefulness as a power producer would not be seriously affected in the plutonium production mode.

The LWR is the most mature and widely used reactor technology for power production available today. Over 100 LWR electric plants are operating in the U.S. The light water technology includes an extensive background of experience in design, licensing, equipment fabrication, construction, operation and supporting infrastructure. Thus, there is good confidence in meeting construction and review schedules for a light water reactor based on current pressurized water reactor (PWR) commercial technology, modified to achieve tritium production. The alternative of a small sized (600MWe) light water reactor incorporating passive safety technology represents an advanced approach which is being developed for future commercial application.

The Heavy Water Reactor technology is unique in its proven capability to produce tritium, plutonium, and transuranic isotopes. HWRs have been operated reliably and predictably at the Savannah River Plant for over 34 years and have accumulated over 130 reactor-years of operating experience. This HWR experience and commercial LWR technology provide an extensive reactor technology data base upon which to design and construct a modern HWR. The deficiencies in the safety data base are being addressed by the DOE's program at Savannah River and should not constitute a technological barrier. These low temperature reactors do not incorporate steam generating equipment.

The HTGR-NPR conceptual design has been completed and a preliminary design is underway. The concept must be further developed into a detailed design, including design of the supporting facilities. There is experienced capability to achieve the final design for the HTGR-NPR based on the operating history of gas cooled experimental and power reactors in the U.S. and world-wide. The proposed modular concept is well suited for the incorporation of passive safety features, as presented in the conceptual design.

The various LMR reactor and tritium production concepts require evaluation and the selection of a specific approach for the NPR. The general state of LMR technology, world-wide, is approaching commercial status. Nevertheless, extensive development, testing, and qualification work remains to design and validate a NPR version of the LMR.

In summary, the maturity of the integrated candidate target-reactor technologies necessary to achieve tritium production would clearly favor the HWR technology since there exists proven target and reactor facilities and operating experience at Savannah River. A HWR design phase and safety review are needed; however, it would be based on existing technology, and, therefore, would be built with confidence in meeting cost and schedule estimates and performance specifications. For power production, a LWR would offer the most mature technology base considering the extensive industrial structure derived from support of both commercial electric power plants and naval reactors; however, the LWR lacks a fully proven target technology. The advanced technology reactors (HTGR, LMR, and concepts such as a small advanced LWR) offer the potential to contribute substantially to the advancement of new commercial designs through the application of passive safety technology. Of these, the HTGR leads since its target technology is the most advanced after the HWR and because a HTGR-NPR design has been established.

FINDING: The HWR has the most mature U.S. technology for tritium production at the present time. The other reactor types require varying degrees of research, development, and qualification testing of the lithium target technology to make tritium, with the HTGR target technology being the most advanced. The LWR has the most mature and widely used reactor technology for power production.

Safety and Environmental Aspects

Safety is a primary consideration in the design, construction and operation of the NPR, and is of major importance to the NPR technology selection. The NPR must provide a level of safety at least equivalent to the best of the present commercial power reactors. Passive safety features incorporated in certain of the NPR designs provide opportunities to exceed the level of safety provided by current commercial reactors.

This high level of safety can likely be achieved with each of the candidate technologies, but through varying mechanisms. In each case, a low radioactive release potential is achieved by a mix of passive and active or engineered safety features. The passive features rely on the physical properties of the materials and systems and include low power density, negative temperature coefficients, and natural convection removal of decay heat. Active or engineered features rely primarily on mechanically or electrically activated mechanisms.

The proposed HTGR and LMR technologies, and such concepts as the small advanced LWR, utilize passive principles to mitigate severe accidents. Proponent's analysis indicates that certain of the severe accident sequences can be passively mitigated such that reactor damage will not occur for long periods (hours or days) without the intervention of active controls or operators. If these results are confirmed through the detailed design and safety review process, they would represent an improvement in reactor protection and public safety over present systems. Such characteristics would be a great advantage not only for DOE production operations but also for commercial power plants.

The operating HWRs and LWRs have some passive safety features, but response to safety challenges relies to a substantial degree on active safety systems. Experience has shown that these active systems provide a high degree of protection to the public and to the operators. In the NPR concepts, increased levels of safety relative to operating commercial reactors are anticipated through greater utilization of passive features and the improved safety data base that has been developed world-wide for water reactors.

Most of the safety analyses presented in the proposed NPR designs did not include explicit consideration of the target behavior. As the targets become more completely defined, it will be necessary to increase the level of detail in the safety analysis.

The ERAB stresses the importance of control of environmental impacts from facility operations and waste disposal as criteria in concept selection and project definition. Refueling operations for all NPR concepts are designed to prevent releases of radioactivity to the environment. The thermal releases from the reactor operations of HWR and LWR are approximately 2500 MWt to produce goal quantities of tritium. The thermal releases of the HTGR and LMR are lower, only 1700 MWt, and therefore require less cooling water. Effective control of tritium in the reactor coolant and within the containment must be maintained. There should be effective monitoring of the secondary cooling water to immediately detect small radioactivity releases from the primary system, as well as atmospheric monitoring in the vicinity of the facilities. Provision is needed for prompt monitoring and communication systems to aid in the execution of emergency plans in the event of an accidental release.

Low levels of radioactive release to the immediate reactor environment would be achieved by different mechanisms for the four reactor concepts. For the MHTGR, the coated particles provide very high retention of fission products at the source. The other concepts rely on high-integrity metal cladding to retain fission products within the fuel elements. The fuel elements for all technologies are expected to limit fission product releases such that environmental and personnel exposure criteria are satisfied. In addition, both the MHTGR and LMR provide coolant cleanup systems to further minimize contamination and sources of radiation. These coolant systems can be maintained at low radiation levels to permit contact maintenance of primary system components.

The HWR operating experience has been favorable, and low operational exposure of personnel has been experienced. The LWR exposures for plant workers, while higher than those of the HWR, are within current standards. It is expected that all the NPR technologies will have acceptable environmental releases and personnel exposures, with the HTGR having the lowest exposures and the LWR the highest.

The LWR technology has had extensive safety reviews, while the HWR technology has the least safety review experience. The other two technologies are intermediate in their experience with safety review processes, with the HTGR having some advantage. The LWR safety review process is well established for pressurized water reactors of the type represented by WNP-1 and the SWR. These reactors represent current vintage plants that are similar to the commercial designs being reviewed by the NRC. In fact, WNP-1 progressed through the NRC licensing review process to the point of receiving a construction permit, and applying for an operating permit. The SWR design has many similarities with late-model Westinghouse PWR plants that have been reviewed and approved for operation by the NRC. The advanced, small PWR with enhanced passive safety features has not received any licensing review by the NRC, and may introduce new review requirements to validate the new reactor and system designs.

The safety review process for the HTGR is not as well established as it is for the LWR. The experience base is represented by licensing activities for Peach Bottom 1 (now decommissioned), Fort St. Vrain (operating), Fulton and Summit (licensed through Construction Permit stage prior to cancellation). In addition, NRC's review of the commercial standard MHTGR is in progress with a Safety Evaluation Report (SER) and a licensability statement expected in mid-1988. While the current NRC review of the MHTGR is not being conducted to the depth of a licensing review, it is expected to deal with all substantive safety issues associated with the commercial MHTGR.

A significant regulatory background for the LMR has been provided by the interaction with NRC on FFTF, CRBR, and more recently SAFR and PRISM. This regulatory background, backed by the extensive safety research programs over several decades involving many safety experiments, computer code developments, and methods of analysis provides an extensive technology base for the safety review process.

Safety review experience for the HWR is mostly limited to internal reviews for the DOE. There has been no recent NRC interaction in safety reviews of reactors similar in design to the SRP production reactors. However, many of the safety features of the LWR are applicable to the HWR, and the HWR would benefit from the LWR licensing and safety review experience.

NRC reviews of reactor systems do not fully apply to the NPR. All of the proposed NPR power generating designs could probably meet NRC requirements for the safety systems design. However, the NRC regulatory requirements are not specific to the NPR core design with target materials (especially lithium) and target designs. NRC evaluation factors for management systems for commercial reactors may differ from the evaluation needed for one or two production reactors operated by a DOE contractor on a government reservation.

FINDING: With proper design and a sound safety review process, each of the technologies can provide a NPR with a level of safety that is at least equivalent to that of the best of present commercial power plants. Radiation exposures to people, both on-site and off-site, are expected to be less than current practice. The advanced reactors (HTGR, LMR, and such concepts as a small advanced LWR) provide an opportunity for a potentially significant advancement in the level of safety over current commercial reactor experience.

Schedule and Cost

The ERAB notes that all of the candidate technologies (except the partially completed WNP-1) have extended lead times -- nine to ten years from project initiation to full production, according to the proponent's estimates. The key steps controlling these project schedules are design and design verification, tritium target development and qualification, development of the safety and environmental data base; construction, and quality assurance. Since the Department has not yet completed steps needed to initiate the project, namely project definition, preparation of an environmental impact statement, safety review procedures, and contractor selection, the actual schedules may extend beyond the proposed nine to ten year estimates unless the Department can mobilize support for an accelerated effort. Actions for accelerating the schedule are discussed in Chapter IV, Section B.

The greater the technical maturity, the higher the likelihood that the planned schedule can be achieved. In this respect, the HWR is clearly in the lead since the target technology is in place. The HWR needs only to complete the safety data base and analyses, and these are underway.

The LWR has an advantage with respect to schedule since detailed reactor designs are available and there is an extensive industrial base that can be adapted to the NPR application. The main schedule risk for the LWR stems from uncertainties in target technology and the potential need to develop and qualify the selected target configuration in an operating LWR, a process that could take as much as four years to complete. There could be difficulty in finding a reactor in which target testing, if needed, can be performed. For commercial reactor operators to be willing to change the basis of their operating license to accommodate such tests, government assistance would be required.

Compared to other advanced concepts, the HTGR has an advantage with regard to schedule risk since the reactor concept is well defined and target qualification could potentially be completed in a research reactor within a period of about two years. However, there is moderate schedule risk in the detailed design and design verification, safety review, tritium extraction facility design, and the construction of a reactor based on a concept that is new, even though it utilizes previous reactor experience.

The LMR is in the weakest position with respect to schedule since it lacks a defined production concept and a defined target technology. Following project definition, selection of a target technology, and selection of an industrial contractor team, there would still be a moderate schedule risk in the remaining phases of the project.

The assessment of project cost estimates parallels the analysis of schedule. The ERAB received and reviewed cost estimates submitted by various proponents. These costs are not included here because they were developed on very different bases and could be used only for qualitative comparisons, which has been done where possible. The greater the degree of technological readiness, the greater the reliability of the estimated costs. The lack of a NPR project definition is another reason that the cost estimates are preliminary and subject to uncertainty.

Moderate confidence can be placed on the HWR and LWR cost estimates. In the case of the HWR, the reactor concepts are based on more than 30 years of Savannah River Plant experience and the supporting fuel cycle and target facilities are defined with a high level of confidence. In the case of siting at Savannah River, these support facilities are already in place. The LWR estimate of the reactor plant cost carries high confidence since it is based on a detailed design and actual construction experience. The specific reactor design has not been determined, however. Costs of the target facilities are not well defined at this time. If modular designs were to be considered for the HWR and LWR, it is likely that the cost per unit of output would be increased because of the smaller sizes of the modular units.

There is less confidence in the cost estimates for the advanced modular reactor concepts. In the case of the HTGR-NPR, even though the estimate is based on a specific modular reactor design, the technology is less mature than that of the HWR and LWR. The immaturity of the LMR-NPR concept makes that cost estimate even more uncertain.

The initial cost to convert the WNP-1 to tritium production is relatively firm since the plant is 63% complete. The WNP-1 cost is about 2/3 the cost of a new HWR at Savannah River, based on the HWR conceptual design. Since there would be energy revenues, the tritium production cost for the WNP-1 option is likely to be lower than for a HWR.

The ERAB has considered several estimates of potential revenues from the sale of steam or electricity. The estimates have come from the reactor proponents, from the technical support crosscut cost group, and other sources. There is considerable variation in the revenue estimates (about 15 to 60 mills/kwH) depending on the assumptions for several uncertain factors:

- The site-related price for steam or electricity, which is related to the regional price for electricity and the utility's costs of getting NPR energy into the grid and to the point of use.
- The degree to which the utility can consider the NPR energy firm and avoid construction of its own generating plant.
- The rate of growth of regional demand for power.

The extent to which revenues from energy sale will reduce the life cycle cost of the high temperature power reactors cannot be determined accurately at this time. The revenues will differ among the high temperature reactor concepts and will be determined in negotiation with electric utilities at the potential sites.

FINDING: Each of the reactor types considered can meet the mission requirements of a NPR with varying degrees of risk as to cost and schedule.

FINDING: The HWR presents the least schedule risk because of the existing facilities, personnel, and experience at Savannah River. Given at least ten years to achieve full production status, all candidates could meet the schedule.

FINDING: A HWR, being a low temperature reactor with no production of steam or electricity, would have the lowest initial cost of any new NPR. The other technologies offer the possibility of revenues from energy sales that, in some circumstances, could offset a significant fraction of the NPR costs.

FINDING: Conversion of the partially completed WNP-1 reactor to nuclear materials production is a special case of the LWR technology. It offers the possibility of a shorter schedule and lower initial cost than a NPR. Safety and environmental aspects would be comparable to those of present commercial LWRs. Target development similar to the SWR is required for the WNP-1, and the cost and time required to obtain public acceptance of conversion of a "commercial" reactor and to implement legal processes to acquire the reactor are uncertain.

IV. ISSUES

The basic rationale for new production reactor capacity is to guarantee the strategic supply of tritium (and plutonium, if necessary) for the nation's security. To be sure that the strategic supply of tritium will be available, the NPR must be built in a timely manner and, once built, be able to assure safe and reliable production of nuclear materials for many decades. Therefore, the issues of production assurance and schedule must be addressed in the selection process.

The most important factor in production assurance is the maturity of the technology, which has been discussed in Chapter III. Related issues lead to consideration of redundancy and diversity of production facilities (duality), the need for continued work on new and advanced technology, and consideration of the option to sell steam or electricity.

A. Duality

Duality includes a set of options that may be implemented to increase production assurance. These options all consist of various ways of using two or more reactors for new production capacity.

Multiple Reactors of the Same Type

Because of the need to provide fuel cycle and target facilities at each selected site, it is preferred that deployment of multiple reactors of the same type would be on a common site. The size of each unit and the number of units would depend on the design concept and on the redundancy desired in production capability. One approach is the use of modular reactors, i.e. multiple small reactors whose components are fabricated off-site and erected at the site.

If designed properly, the advantages of multiple reactors include the following:

- There is reduced risk of simultaneous loss of all capacity.
- There would be greater flexibility in obtaining a mix of products, should that be desired. Target replacement schedules can even out the workload in target and fuel processing facilities. There is also the possibility of keeping at least part of the capacity in operation at any given time while other units are down for refueling or maintenance; there is therefore the ability to make a firm commitment for energy supply to a utility customer for part of the capacity, gaining more power revenue than could be obtained from a single NPR.
- The smaller units, with their lower decay heat levels, have increased potential for use of passive safety features, thereby reducing overall severe accident risks.
- The earliest modules could be put into operation while later modules are still under construction, thereby gaining product, and possibly revenue, sooner.
- Flexibility is provided to add additional units if desired, for example to provide redundancy above goal production capacity.
- Modular designs could provide increased control of costs, quality and schedule by utilizing a factory rather than a field environment for much of the fabrication.

The disadvantages of multiple units are relatively modest as applied to a NPR:

- There is increased first cost for the reactor facilities as the result of smaller units.
- A somewhat larger staff for operation of the facilities is required.

FINDING: Multiple smaller reactors of the same type offer advantages of protection against loss of all capacity, flexibility, and increased potential for the use of passive safety features, but at some added cost. This approach should be considered for all technologies.

Diversity of Technologies and Sites

If more than one technology were selected for new production capacity, it is preferred that they be deployed at different sites. The use of two technologies at two sites would have some of the advantages cited above for multiple reactors at one site as well as the following benefits:

Benefits of Two Sites

- Protection would be provided against loss of capability by naturally occurring external events (earthquakes, storms, etc.) that might damage a particular site.
- Increased protection would be provided against espionage, site intrusion, or other deliberate events that could jeopardize production.
- The threat of an accident at one reactor affecting operation of the other would be reduced.

Benefits of Two Technologies

- The risk of losing all production capability from safety or technical problems with one of the technologies would be eliminated.
- A phased schedule for diverse technologies might permit deployment of one technology to provide part of the needed NPR capacity, while more time is taken to consider a second reactor technology.

Some of the generic shortcomings of two technologies or two sites are the following:

- The costs of two projects will be greater than the costs of a single project. Increased preoperational and capital costs can be somewhat mitigated by phased schedules and, possibly, by revenues from the sale of steam or electricity. The long-term difficulty of maintaining resources for two different projects may be prohibitive unless revenues were substantial.
- The DOE will need to provide strong management and safety review staff for two parallel enterprises.

DOE must balance the reliability benefits of the diversity approach against the higher costs. There may be strategies that capture some benefits of diversity and at the same time minimize costs (for example, by developing existing capability such as WNP-1 or FFTF). In any case, DOE should consider the benefits of perfecting one or more additional target technology options so that future decisions on NPR technologies can be made with more assurance than at present.

Diversity could be obtained through the use of two reactor technologies co-located at a single site. This has all of the increased costs of providing complete facilities for the two technologies with none of the protection against natural or deliberate events that come from two sites. The benefit against a complete stop to production from an accident at one of the reactors is compromised. For these reasons, diversity has been considered here principally to mean two sites.

Similarly, multiple reactors of the same type could be deployed at multiple sites. This option has all of the increased costs and management burdens of diversity at two sites without the protection against loss of capacity resulting from safety or technical problems with a single technology. The benefits of the second site, listed above, do not of themselves justify the increased costs and management burden. For these reasons, multiple reactors of the same type were considered above to be co-located at a single site.

OVERALL FINDING ON DUALITY: A multiple reactor strategy, possibly with diverse technologies, would provide high production assurance, reduce uncertainties in the NPR schedule, and minimize the technical risks to national security, but at increased cost. A single unit NPR is the lowest initial cost option, but carries the operational risk of unexpected loss of all capacity for an extended period. If a single-technology option were selected, it would be prudent to develop or qualify target technologies for other reactor types to provide for future contingencies.

B. Urgency of the Schedule

Chapter III notes that all of the technology options have extended schedules that are further increased by the front-end needs for project definition, authorization and funding. Consequently, it is the sense of the ERAB that it is urgent to begin the process now.

Central Schedule Problem

Two technical elements are at the center of the concerns of schedule risk. The first element is the schedule risk in providing fully qualified tritium target and reactor technology. The research, development and qualification testing needed to assure that the technology will perform as required must be carried out successfully.

The second element of schedule risk is the time required to complete the safety review process. The review process itself is not yet defined, and this is part of the concern. In addition, experience with present NRC and DOE regulatory processes indicates that preparing for and proceeding through safety review processes can be very time consuming. It is likely that all the technologies would eventually satisfy the safety review, but some technologies and their proponent organizations are better prepared and have more experience with review processes than others.

There is a schedule risk with the target development in every case except the HWR. There is a schedule risk with reactor technology and with the time required for the safety review process in every case. The time and funds needed for technology development can be estimated with some confidence because of experience in the management of advanced development programs. The ERAB has less confidence that the time required to complete the safety review process can be estimated accurately because experience is more limited, the review process is not yet determined, and the process is inherently more subjective. The safety review is anticipated to be difficult for every technology, and organizational strength will be required for each selected alternative. Difficult assessments of each risk must be made by the Department, especially if it chooses a single technology for the NPR.

FINDING: Each of the technologies can be utilized for a NPR with further preparation. The needed preparation differs in each case and may include research, development, or qualification of part of the technology, and it will include analysis and testing to provide data for a safety review and approval process.

Safety Review Process

A high degree of emphasis on safety and environmental concerns is needed from the start of the project to protect the public and plant personnel, and to provide the facility and environmental data base, records, and quality assurance information needed to satisfy safety and environmental reviews. Moreover, there is a need to define the safety and environmental review process and the required environmental data base at an early stage so that an optimal schedule can be established. The organizations conducting the reviews must be staffed with qualified personnel. The process must be sufficiently robust that challenges will not seriously impact the project schedule.

The safety review process should consider means for public participation through mechanisms that would be compatible with the overall schedule. For example, such mechanisms are built into the environmental impact review process and there may be additional opportunities. The process should also contain sufficient elements of independent review.

The concept proponents have made concerted efforts to address the known safety issues and concerns. In the opinion of ERAB, all the technologies being considered can exceed safety goals established for commercial power plants by a significant margin. If this judgment of a high degree of safety is sustained in the NPR safety review process, the overall schedule should benefit.

FINDING: DOE, in consultation with its independent safety oversight bodies, should establish the review process for the NPR project without delay. The DOE should provide adequate qualified personnel and budget.

Management Organization

Experience with earlier government and commercial nuclear projects indicates that attention to strong project management, safety, quality assurance, environmental monitoring, waste considerations, and public acceptance must be made an integral part of the program to avoid schedule delays. A centralized management team is needed with a technically strong supporting staff in all relevant areas.

FINDING: A strong management organization with authority and accountability for all aspects of the NPR program is necessary to achieve the schedule goals.

Government Commitment to Schedule

The NPR goals, performance requirements, acquisition strategy, and the possible need for energy production have not yet coalesced into a well focused project definition. Although the initiative for focus of this program must come from the Department of Energy, the Department of Defense should certify the requirement. A clear agreement on the project definition by all the institutional entities of the Administration and Congress is important to minimize schedule risks.

A major risk is introduced by the annual government funding process. A high degree of commitment by the Administration and the Congress over many years will be necessary to build and startup the NPR facilities on a firm schedule. Ideally, initial authorization and appropriation of the full project is preferred.

The DOE can take some steps on its own to expedite the NPR acquisition schedule. The Department should begin project definition, form the management team, and budget for the needed research, development, and testing early in the project schedule.

Other important actions to accelerate and guarantee the schedule require Congressional authorization: initiating long-lead procurement and performing engineering design in parallel with the NEPA documentation process, and authorization and appropriation of funds for all design and supporting activities prior to the constructions of a NPR.

FINDING: Successful development, design, construction, and startup of a NPR requires a continued commitment from both the Executive Branch and the Congress over many years.

FINDING: DOE should seek an expedited schedule for acquisition of the NPR, including legislative relief from existing constraints where needed.

C. Production of Steam or Electric Power

Production of energy for sale introduces complex tradeoffs between potentially lower product costs, higher initial costs, and the possible reduction in operational reliability of a more complicated reactor plant.

The revenues from energy sale are mainly dependent on the site and the timing of contracting between DOE and the utility purchasers. Utilities normally have a ten year planning horizon as a minimum for the purchase or development of capacity to meet anticipated demand. The value of firm capacity is significantly greater than energy sold on short term contracts or with intermittent availability. For DOE to maximize revenues from the sale of steam or electricity, it would be necessary to negotiate firm contracts with a utility at least ten years before the energy is available and commit to a firm increment of capacity. If the energy is not available by the contract date, DOE would be obligated to pay for the capacity until it becomes available. Conversely, energy for sale prior to the agreed date and energy in access of the agreed capacity could only be sold at a much lower non-firm rate. Contract negotiations may be less favorable to the DOE because of the limited sites being considered, and designation of a specific site would further reduce the DOE's bargaining power. The candidate sites were originally chosen as DOE facility locations in part because the cost of power was low, and this may minimize the potential revenue when the NPR is operational.

The above considerations of contracting for the sale of energy complicate the assessment of the economic benefit of power production by the NPR. Estimates of possible revenues from energy sales that have been available to the ERAB vary significantly from the most favorable case to the least favorable case. To obtain the most benefit, the DOE must have legislative authority to execute long-term contracts.

The power-producing technology options generally have higher front-end costs, recaptured several years later from power revenues. The attractiveness is strongly dependent on the discount rate of the evaluation.

The potential advantages of producing steam or electricity from a NPR, given favorable revenues are:

- o Revenues from sale of energy can offset a significant fraction of the NPR costs, in some circumstances, thereby providing a lower unit cost for defense materials than would be obtained from a low temperature non-power producing reactor.
- o The NPR, depending on the choice of technology, could demonstrate a major advance in nuclear reactor technology with potential benefit to the nation's use of nuclear power.
- o Energy conservation suggests that the large amount of energy generated in the tritium production process should be used for practical applications to the extent thermodynamically possible as opposed to rejecting all the energy to the environment.
- o The ability to produce tritium in power reactors increases the ability of the country to respond to an unexpected demand for increased supply. Some foreign countries already use power reactors for defense materials production.
- o The availability of a second product from the NPR would provide incentives for completing the project even if the demand for tritium were greatly reduced or disappeared. The second product would also provide revenues to offset the cost of continuing to operate a reactor during periods of low demand.
- o Sale of steam at the site boundary to a local electric utility rather than sale of electricity reduces the cost and complexity of the NPR plant and may still provide significant revenue to help offset costs.

The disadvantages regarding steam or power production include:

- o None of the high-temperature tritium target technologies associated with power production is ready for production deployment, introducing some development and facility costs, and schedule risks.
- o Electricity production introduces institutional and technical complications, i.e. interactions with utilities, outside regulatory agencies, larger project scope, etc. that could cause loss of focus on the primary production objectives and increase schedule risk. These disadvantages may be reduced if the NPR sells steam rather than electricity.
- o Electricity production would increase design and quality assurance complexity.
- o U.S. policy heretofore has been to clearly separate the weapons material production fuel cycle from the civilian power reactor fuel cycle to maintain a consistent policy on non-proliferation of nuclear weapons production in third-world countries. A change to

this policy could introduce political risks to the NPR project. Moreover, this policy change could further hurt the prospects of civilian nuclear power.

The ERAB analysis suggests that there are potential benefits from the sale of steam or electricity by the NPR, but they are not likely to be as great as those claimed by the power reactor proponents. If the NPR supplied steam to a utility for conversion to electricity, then weapons defense material production would be better separated from electric power production, DOE's initial investment would be reduced, and external institutional interactions with regulatory agencies and individual utility customers would be reduced.

FINDING: With early planning, there is an opportunity to gain revenues to offset costs by the sale of steam at the site boundary for power production.

V. OPTIONS

If there is a need for full tritium production as early as possible, then options are limited to the HWR and WNP-1 conversion. The HWR appears to have the best chance of quickly providing the needed capacity because of the existing facilities, personnel, and experience at Savannah River. The ERAB recognizes that the WNP-1 may provide a unique opportunity for conversion to tritium production at relatively low capital cost while providing some revenues from the sale of steam. However, there are schedule risks because of the need to demonstrate an adequate target technology, uncertainties of public acceptance of conversion to defense purposes, and possible delays because of the legal processes required to acquire the WNP-1 facility.

If new production capacity to provide goal quantities of tritium can be phased into operation over a time period beginning in about ten years, then additional opportunities are presented. The Board believes that a combination of technologies, including advanced technologies, offers a unique opportunity that should be carefully considered, even at increased costs, for a step increase in reactor safety and a substantial improvement in commercial reactor technology.

Appendix A

THE SECRETARY OF ENERGY
WASHINGTON, D.C.

January 7, 1988

Dear Mr. Schoettler:

The Department of Energy is responsible for the research, development, testing, production, retirement and assessment of the reliability of nuclear weapons. As part of this responsibility, the Department has decided that construction of a New Production Reactor (NPR) is essential to meet US requirements for nuclear weapons materials. The primary mission of the NPR will be to produce tritium.

The Department is limiting its consideration to four reactor types as candidate technologies for the NPR. They are the Low Temperature Heavy Water Reactor; Light Water Reactor; High Temperature Gas-Cooled Reactor; and Liquid Metal Reactor. In selecting one for the NPR, the Department must consider such factors as: the ability to meet mission requirements based upon scientific and technological maturity; the impact of pertinent health, safety and environmental considerations on site selection, construction and operation; engineering and operational capabilities of the US industrial infrastructure; and projected costs and schedule risks. The Department has developed an initial version of detailed criteria.

I am asking the Energy Research Advisory Board to conduct a review and assessment of: 1) the Department's proposed selection criteria for the NPR; 2) the adequacy of each of the four candidate reactor technologies to meet the criteria; and 3) schedule and technical risks, benefits and costs in implementing a NPR program with each technology.

DOE will provide a support team to meet the technical and administrative requirements of the Board and its staff. Working papers and supporting analysis for the study will be initiated immediately in anticipation of the Board's needs.

In view of the intense interest in and importance of this study, I would appreciate an interim written report by March 1, 1988 regarding selection criteria and a final report of your findings by June 1, 1988.

Yours truly,

John S. Herrington

John S. Herrington

Appendix B

THE SECRETARY OF ENERGY
WASHINGTON, D.C.

April 28, 1988

Dear Mr. Schoettler:

I appreciate the rapid start of the Energy Research Advisory Board (ERAB) to my request of January 7, 1988, to evaluate candidate reactor technologies for application as New Production Reactors.

Current budget legislation, i.e., Making Further Continuing Appropriations for the Fiscal Year 1988, and For Other Purposes (Public Law 100-202), directs that the Department's acquisition strategy report for new production capability include an analysis of whether or not there should be two or more replacement production reactors, either concurrently or sequentially. The legislation further requests an analysis of the use of alternate reactor technologies at one or more sites.

My consideration of duality, i.e., diversity of reactor technologies and more than one site, in my decisions on reactor technology and siting would benefit from the ERAB's consideration of duality in their evaluation of reactor technologies. Therefore, I request that duality issues be included specifically in your assessment of the reactor technologies.

Thank you for your assistance in helping us clarify this issue.

Yours truly,

John S. Herrington

John S. Herrington

Mr. John H. Schoettler
Chairman
Energy Research Advisory Board
11855 East Daley Circle
Parker, CO 80134

Appendix C

MEETINGS HELD BY ERAB AND ITS PANEL
ON
THE NEW PRODUCTION REACTOR TECHNOLOGY ASSESSMENT

Jan. 22, 1988	NPR Steering Committee	Los Angeles, CA
Feb. 10-11, 1988	ERAB Meeting	Washington, DC
Feb. 11-12, 1988	NPR Panel - Initial Meeting	Washington, DC
March 1-2, 1988	LWR Subpanel	Albuquerque, NM
March 3-4, 1988	LMR Subpanel	Albuquerque, NM
March 7-8, 1988	HTGR Subpanel	Germantown, MD
March 9-11, 1988	HWR Subpanel	Boston, MA
March 23-24, 1988	NPR Panel - Tritium Technology	Argonne, IL
April 19, 1988	Subpanel Meetings	Los Angeles, CA
April 19-20, 1988	NPR Panel - Consolidate Information	Los Angeles, CA
May 24, 1988	NPR Panel - Final Meeting	Washington, DC
June 13-15, 1988	ERAB - Findings and Report	Livermore, CA

Appendix D

LIST OF RELEVANT REPORTS

I. Subpanel Reports

The four subpanel reports have each been prepared in support of the ERAB Panel on the NPR Technology Assessment. They will be made available by Science Applications International Incorporated (SAIC).

1. ERAB Subpanel Report, Heavy Water Reactor Technology, SAIC Report No. _____, to be published, 1988.
2. ERAB Subpanel Report, High Temperature Gas-Cooled Reactor Technology, SAIC Report No.____, to be published, 1988.
3. ERAB Subpanel Report, Light Water Reactor Technology, SAIC Report No.____, to be published, 1988.
4. ERAB Subpanel Report, Liquid Metal Reactor Technology, SAIC Report No.___, to be published, 1988.

II. Technical Support Group Crosscut Reports

The following reports have been prepared by DOE contractors or by the DOE as background information for the NPR Technology Assessment. They will each be available from the institution publishing the document.

1. Engineering Technology Assessment Report, Argonne National Laboratory, ANL-NPR-2, to be published, 1988.
2. Safety and Environmental Report, Science Applications International Inc., SAIC-88/1706, May 23, 1988.
3. Fuel Cycle and Target Technology Group Report, Los Alamos National Laboratory, LA-CP-xxx, to be published, 1988.
4. Cost Evaluation Technical Support Group Report, Department of Energy, DOE-DP-0052, to be published 1988.
5. NPR Capacity Technology Assessment, Schedule Committee Report, Argonne National Laboratory, ANL-NPR-1, to be published, 1988.
6. NPR Alternative Concepts Review Report, Los Alamos National Laboratory, LA-CPxxxx, to be published, 1988.

Appendix E

Energy Research Advisory Board
to the
United States Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585
(202) 586-5444

MAR 1 1988

The Honorable John S. Herrington
United States Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Dear Mr. Secretary:

The Energy Research Advisory Board (ERAB) has appointed a Panel to consider the New Production Reactor (NPR) on a timely schedule in response to your letter to the Chairman of ERAB on January 7, 1988. The Board has completed its review and assessment of the Department's proposed selection criteria for the NPR, with the findings given in this interim report. Future activities will cover the rest of your charge to the Board; namely, review and assessment of the adequacy of each of the four candidate reactor technologies to meet the criteria; and schedule and technical risks, benefits and costs in implementing an NPR program with each technology.

The four reactor technologies being considered are the Low Temperature Heavy Water Reactor, the Light Water Reactor, the High Temperature Gas-Cooled Reactor, and the Liquid Metal Reactor. A subpanel of the NPR Panel has been appointed for each of these technologies.

The goal of the NPR is to produce required quantities of tritium at the earliest possible date and, thereafter, on an assured, sustained, safe, and environmentally and institutionally acceptable basis. The Department's proposed selection criteria to meet this goal were reviewed and discussed at the Board's February 11 meeting in Washington and at the Panel's February 12 meeting in Washington. The recommended set of top-level criteria are:

- Ability to produce goal quantities of tritium on a timely schedule.
- Ability to meet safety and environmental requirements.
- Assurance of availability of reactor, fuel, target, and processing technology for full-scale production on an urgent schedule with low schedule risk.
- Ability to meet the goal in a cost effective manner.
- Availability of personnel, material, and facilities necessary to design, develop, manufacture, construct and operate the NPR.
- Contributions to the advancement of nuclear technology, the implications of duality, public acceptance, and the impact of the sale of steam or electric power on the above criteria.

The Board emphasized the equal and primary importance of producing goal quantities of tritium when needed and doing so in a safe and environmentally sound manner (the first two criteria). By implication the other criteria would receive less weight in the evaluation process.

The Board has identified public acceptance as part of the acceptability criterion in order to evaluate the effect of this factor on meeting the goal of the NPR on a timely schedule.

The Board endorses the concept that the Project meet NRC safety goals as stated in the explanation accompanying the second criterion. The DOE should assure that the NPR meets safety requirements that are equivalent to those of the NRC.

The last criterion above includes an assessment of the technologies if dual reactors of full or lesser power are considered (duality). There are various possibilities for duality including diversity of technologies and sites, redundancy of some of the capacity by one or more reactor technologies, etc. I understand that the Department will provide clarification to the ERAB of the extent to which the Board should consider duality.

The revised explanation describing the criteria and a listing of the criteria evaluation factors are attached to this report. These revised criteria will be used by the ERAB in its continuing review and assessment of the four reactor technologies.

The Board has scheduled two Panel meetings and additional subpanel meetings during the next several months. A tentative schedule is attached. The ERAB has changed its meeting schedule to accommodate the needs of the Panel. The Board will now meet in June to review the work of the Panel and will prepare its findings for presentation to you in a final report by July 1, 1988.

Sincerely,

John H. Schoettler

John H. Schoettler
Chairman
Energy Research Advisory Board

Attachments:

1. Panel Members and Advisors
2. January 7, 1988 Charge Letter
3. Explanation of Criteria
4. Listing of Criteria
5. Tentative Schedule of Panel Actions

THE SECRETARY OF ENERGY
WASHINGTON, D.C.

January 7, 1988

Dear Mr. Schoettler:

The Department of Energy is responsible for the research, development, testing, production, retirement and assessment of the reliability of nuclear weapons. As part of this responsibility, the Department has decided that construction of a New Production Reactor (NPR) is essential to meet US requirements for nuclear weapons materials. The primary mission of the NPR will be to produce tritium.

The Department is limiting its consideration to four reactor types as candidate technologies for the NPR. They are the Low Temperature Heavy Water Reactor; Light Water Reactor; High Temperature Gas-Cooled Reactor; and Liquid Metal Reactor. In selecting one for the NPR, the Department must consider such factors as: the ability to meet mission requirements based upon scientific and technological maturity; the impact of pertinent health, safety and environmental considerations on site selection, construction and operation; engineering and operational capabilities of the US industrial infrastructure; and projected costs and schedule risks. The Department has developed an initial version of detailed criteria.

I am asking the Energy Research Advisory Board to conduct a review and assessment of: 1) the Department's proposed selection criteria for the NPR; 2) the adequacy of each of the four candidate reactor technologies to meet the criteria; and 3) schedule and technical risks, benefits and costs in implementing a NPR program with each technology.

DOE will provide a support team to meet the technical and administrative requirements of the Board and its staff. Working papers and supporting analysis for the study will be initiated immediately in anticipation of the Board's needs.

In view of the intense interest in and importance of this study, I would appreciate an interim written report by March 1, 1988 regarding selection criteria and a final report of your findings by June 1, 1988.

Yours truly,

John S. Herrington

John S. Herrington

Mr. John H. Schoettler
11855 East Daley Circle
Parker, CO 80134

February 24, 1988

TECHNOLOGY EVALUATION CRITERIA FOR THE ENERGY RESEARCH ADVISORY BOARD STUDY OF THE NEW PRODUCTION REACTOR TECHNOLOGIES

EXPLANATION OF CRITERIA

BACKGROUND

Detrimental aging effects and safety concerns about the current production reactors have resulted in a reduction of the Department of Energy (DOE) nuclear materials complex's ability to meet its mission of producing nuclear materials for national defense. The reactors at the Savannah River Plant currently are operating at 50% of their capacity, and the Hanford reactor is not operating at present. Further detrimental effects could reduce nuclear material production capacity to below that required to sustain the US nuclear weapons stockpiles, which is the primary reason for designating a preferred reactor technology(ies) and site(s) for the construction of replacement capacity for the production of nuclear materials.

Before seeking substantial construction funding from Congress for this project, DOE is conducting an in-depth review of available production reactor technologies and sites. On January 7, 1988, the Secretary of Energy requested that ERAB participate in the review of four reactor technologies. Specifically, this consists of a review of the technology evaluation criteria and an assessment of the various candidate reactor technologies against these criteria. Following the related analyses and evaluations of the ERAB findings, and other information, by the Energy System Acquisition Advisory Board (ESAAB), the decisions on the preferred technology(ies) and site(s) will be made by the Secretary of Energy. Final selection of a reactor technology and a site will be made by DOE subsequent to completion of the review process required by the National Environmental Policy Act (NEPA).

PURPOSE

The ERAB will examine candidate production reactor technologies with respect to the Office of Defense Program's mission requirements for tritium. The flexibility of a design for plutonium production also will be examined. Reactor concepts will be evaluated in terms of the maturity and additional R&D requirements of the technology, the assurance of meeting safety/environmental requirements, schedules and costs, the industrial base and certain institutional factors.

SCOPE OF EVALUATION ACTIVITIES

The ERAB's initial activity has been to evaluate the proposed NPR technology evaluation criteria against which the following reactor technologies will be reviewed: (1) Low-Temperature Heavy Water Reactors, (2) Light-Water Reactors (WNP-1 and Special-Design Water Reactors), (3) High-Temperature Gas-Cooled Reactors, and (4) Liquid-Metal Reactors. The ERAB findings will evaluate data relating to each of the technology evaluation criteria. Each of the technology concepts will be presented to the Panel by their proponents. The status of the reactor technology and how it can be integrated into the Defense Program infrastructure will be assessed.

TECHNOLOGY EVALUATION CRITERIA

The NPR will be required to produce goal quantities of tritium at the earliest possible date and, thereafter, in an assured, sustained, safe, and environmentally and institutionally acceptable way.

Given this goal, the NPR technology evaluation criteria are:

- o Ability to produce goal quantities of tritium on a timely schedule. (Technology Base)
- o Ability to meet safety and environmental requirements. (Safety & Environmental)
- o Assurance of the availability of reactor, fuel, target, and processing technology for full-scale production on an urgent schedule with low schedule risk. (Project Schedule)
- o Ability to meet the goal in a cost effective manner. (Project Costs)
- o Availability of personnel; material; and development, test, and manufacturing facilities necessary to design, develop, manufacture, construct and operate the NPR. (Industrial Base)
- o Contributions to the advancement of nuclear technology; the implications of duality, public acceptance, and the impact of the sale of steam or electric power. (Institutional Acceptability)

The factors that make up each of the criteria are discussed in greater detail in the following paragraphs.

TECHNOLOGY BASE

This category evaluates the maturity of the technology and addresses the technology base for the NPR. For each reactor concept under consideration the current and any required upgrading of the technology base should be assessed. The status of the technology and required R&D should be identified for tritium production; conversion to plutonium production if this option were to be exercised; reactor design, construction, and operation; fuel cycle facilities design, construction, and operation; and regulatory and safety activities. "Regulatory" is defined as those compliance activities stemming from regulations issued by NRC, DOE, EPA and other Federal, state and local agencies.

1. Tritium Production Status and R&D. The reactor and core design, target design, the results of any in-pile testing, target fabrication and reprocessing, tritium recovery techniques, as well as any unique target or fuel waste management schemes should be evaluated. Tritium production is the central feature of the NPR. Examples of specific criteria relating to this aspect which should be considered are production rate, efficiency of production (KG per MW, KG per $, KG per Man-REM - Operating, KG per Man-REM - Public), operational experience, reliability/availability/maintainability/inspectability, sprint/surge capability, tritium production performance at less than design reactor power, and the overall complexity of the production process.

2. Plutonium Conversion Option. The following factors should be addressed under this criterion: the flexibility and capability of the design to convert from tritium to plutonium production; the expected production rate subsequent to such conversion; any pertinent operational experience; the impact of conversion on the reactor in terms of reliability/availability/maintainability/inspectability; the complexity of the conversion process and the time required to accomplish it; and the quality of the plutonium.

3. Reactor and Fuel Cycle Status and R&D. System and component designs and the results of and the requirements for both out-of-pile and in-pile testing should be considered. In addition, custom-designed or first-of-a-kind systems and components identified by the proponents should be addressed. The fuel fabrication and reprocessing technology to be used should be addressed along with the proposed associated waste management approaches. Accident mitigation systems and the results of any experimental and analytical work done on proposed ECC systems should be evaluated. Any potential damaging feedback from the balance of plant (BOP) should be considered. The NPR complex should be evaluated in terms

of reliability/availability/maintainability/inspectability, and the potential impacts on the complex from external hazards.

4. Regulatory and Safety Status and R&D. The status of the safety criteria, guides, and general design criteria applicable to the technology under consideration should be evaluated and upgrades for the given technology identified. The availability of the necessary analytical skills and the status of supporting experimental programs should be addressed. The effort required for validation and for the peer reviews for assuring that the safety goals are in fact being met should be identified. The status of these reviews should also be taken into account. The status of PRA experience, technology and the related data base should be assessed.

SAFETY AND ENVIRONMENTAL

This criterion provides for the health and safety of the public and workers, and assures the ability of the technology to provide reactor safety and environmental protection at least equivalent to those for present, commercial reactors and fuel cycle facilities. Safety related factors to be considered include safety goals, inherent and enhanced safety features, the extent of the source term represented by the technology, external events, the potential for severe accidents, NRC regulatory requirements, safeguards and security, and target and fuel cycle safety. Environmental factors that relate to operating releases and waste management should be addressed.

1. Safety Goals. The ability of the technology to comply with the NRC's safety goals should be assessed with respect to early fatality and latent cancer criteria and the probability of a large release. (During the conduct of the project, the ability of the preferred NPR technology(ies) to meet the NRC safety goals will be established by an independent safety review group.)

2. Inherent Safety Features. Inherent safety features should be identified such as a low power density in the core; low internal energy (low temperature, low pressure, etc.); negative reactivity void, doppler, and temperature coefficients; and the ability to dissipate decay heat in a passive mode upon loss of all active components resulting from an event such as a station blackout (walkaway capability).

3. Enhanced Safety Features. The inclusion of enhanced safety features should be noted. This includes redundant and diverse components, systems, and functions; highly reliable components; significant safety margins; passive engineered safety features for severe accidents; containments; and features that accommodate Anticipated Transients Without Scram (ATWS) events without damage. It is important to note that a containment structure will be required for the NPR.

4. Low Source Term. Postulated source terms can have a major impact on the containment design and isolation capabilities and the perception of risk to the public. A low level of fission product source term following the most severe core meltdown accidents would minimize accident consequences, simplify emergency planning, and reduce containment requirements.

5. External Events. Any unique reactor or system design characteristics that would make the plant vulnerable to external events such as seismic hazards, floods, fires, high winds, and malevolent acts should be identified.

6. Severe Accidents Potential. Because of the high fuel enrichment used in most production reactor concepts, there is a potential for severe accidents. This includes criticality and recriticality following a disruption of certain phases of fuel fabrication or reprocessing, and following an event that damages the core. These accidents should be carefully assessed.

7. NRC Regulatory Requirements. Consideration should be given to the intent of NRC requirements for commercial reactors using the 10 CFR guidelines such as, 10 CFR 50 Appendix A (the General Design Criteria), the Severe Accident Policy Statement, the Standard Review Plan and the evolving advanced reactor policy.

Existing PRAs should be used to estimate compliance with the safety goals noted above. The identification of design basis accidents, and the use of a defense-in-depth approach for the proposed concept should also be addressed.

8. Safeguards and Security. Safeguards and security take on added importance in a production reactor complex. Any unique reactor design or process feature which would either enhance or detract from the security or safety of the reactor complex fuel cycle facilities, transportation facilities, and/or materials control and accountability should be identified.

9. Target and Fuel Cycle Safety. Unique target and fuel fabrication and reprocessing characteristics, and tritium recovery characteristics that would reduce occupational exposures (ALARA) and the potential for toxic releases, and that would enhance industrial and fire safety should be considered.

10. Operating Releases. The level of normal operating releases should be addressed, such as, the level of radioactive gaseous or liquid effluent released to the environment during routine operation of the NPR complex. The level of hazardous effluents released to the environment, and the amount of heat rejected during normal operations and its effect on the environment surrounding the plant should also be addressed.

11. Waste Management. The amount of low, medium, and high level radioactive, hazardous, and mixed wastes generated during the expected life of the reactor could have a significant impact on the safe operations of the complex and the cost of operations. Requirements for on-site facilities for processing, packaging, storage, disposal, and transportation should be evaluated.

PROJECT SCHEDULE

Project schedule combines the assurance of the availability of reactor fuel, target, and processing technology for full-scale production on an urgent schedule with a high assurance of meeting that schedule. This criterion focuses on bringing on line a reactor capable of producing goal quantities of tritium and its supporting facilities as soon as practicable. Examples of major schedule factors which should be addressed for each technology are (1) safety/environmental/regulatory, (2) technology R&D, (3) design, (4) construction, and (5) startup and operation. Specific issues that are expected to be problems for the technology should be highlighted and allowances in the schedule should be made to allow for the resolution of these issues.

1. Safety/Environmental/Regulatory Schedule. This factor focuses on the schedule requirements necessary for meeting the safety goal criteria, the preparation of a full-scope PRA to deal with the safety evaluation oversight group and others, the preparation of a draft Environmental Impact Statement incorporating candidate site considerations, and for obtaining approval for the Preliminary and the Final Safety Analysis and the Environmental Impact Statement.

2. Technology R&D Schedule. The schedule associated with completing the R&D to meet the technological objectives of the NPR should be specified. This should include the experimental programs, analytical modeling, including equipment and component testing programs, and the associated validation and peer reviews necessary to assure that the objectives have been met.

3. Design Schedule. For each technology, this schedule should consider the status of Title I and II designs, the definition of design basis accidents and PRA efforts, and the time required to complete these activities.

4. Construction Schedule. This schedule should take into consideration the experience of available vendors, A-Es, and constructors; the existence of an industrial base in terms of the availability of personnel, material, and development/test/manufacturing facilities to support the effort; the constructability of the design; and any modularity aspects of the fabrication and construction approach that may have an impact on the construction schedule.

5. Startup and Operation Schedule. This schedule should be delineated and should consider such factors as the time required for testing and training, the status of operation standards and procedures required to operate the NPR complex, and the time required to complete these items before commencing production operations.

PROJECT COSTS

One of the project objectives must be to produce, in a cost effective manner, goal quantities of tritium with a high assurance of success. The principal factors related to the NPR complex to be addressed are the preoperational costs, capital facility costs, operating and maintenance costs, including fuel and target, potential offsetting revenues, and production rates. For the purposes of this evaluation, the NPR complex is defined to include the NPR and, if appropriate, a steam or electric power conversion capability, and fuel fabrication, target fabrication, fuel reprocessing, tritium recovery, and target reprocessing capabilities.

1. Preoperational Costs. In this category the costs which should be specified for comparative purposes include the costs of the remaining R&D in such areas as tritium production, reactor and fuel cycle, and regulatory and safety; the conceptual design and engineering efforts that occur prior to the initiation of Title I; the regulatory, safety, and environmental activities to support the project; the activities surrounding the test operations and startup; the preparation of all the operations, maintenance, and testing procedures to operate the NPR complex; and the project management and administration costs associated with these activities.

2. Capital Facility Costs. Costs should be delineated for each of the facilities defined as part of the NPR complex. Specifically, cost estimates related to the design, engineering, and inspection of the facilities (Title I, II, and III); construction; equipment and component procurement; initial spares; initial NPR fuel loading; and project management and contingency should be identified.

3. Operating and Maintenance Costs, Including Fuel and Target. This category should include the costs of operating the complex to meet it's objectives from initial operations to decommissioning. Major examples of factors which should be included are operations and maintenance, component replacement and operating spares, engineering and technical support, training, fuel, targets, waste management, and decontamination and decommissioning.

4. Revenues. The only potential revenues that should be considered at this time are those from the sale of steam or electric power.

5. Production Rates. For each technology, annual tritium, steam or electric power production rates as well as the value of the steam or electric power at the three sites under consideration should be specified. Note that the estimated tritium rates must be treated as classified information.

INDUSTRIAL BASE

This criterion is defined as the extent to which an industry and its infrastructure can mobilize personnel, material resources, and facilities to design, develop, manufacture, construct, and operate the NPR complex. The main factors to be addressed for each technology are the availability of personnel; materials; development, test and manufacturing facilities; and fuel cycle facilities.

1. Personnel. To meet the objectives of this overall effort with a particular technology, it is imperative that the right type of personnel be available throughout the life of the project. Examples of some of the major categories are engineers, safety analysts, designers, as well as construction, operating, maintenance, quality assurance, and management personnel.

2. Materials. For each technology, the nuclear fuel and target materials to be used as well as any other unique, strategic or special materials associated with the technology should be identified, and a determination made as to their availability.

3. Development and Test Facilities. A determination should be made as to the availability of facilities to conduct the required development and testing identified for a particular technology, such as fuel and target irradiation tests, thermal hydraulic tests, first-of-a-kind component tests, etc.

4. Manufacturing Facilities. An assessment should be made of the availability of manufacturing facilities to support the construction of the NPR. Specifically, the availability of facilities to fabricate the nuclear components and the associated codes and standards, specifications and procedures to assure quality products should be assessed.

5. Fuel Cycle Facilities. Except for some commercial fuel fabrication activities, these facilities may be part of an existing program at a Department of Energy nuclear site and should be assessed as part of the industrial base for the concept. A determination, however, should be made as to their availability to the NPR project. These fuel cycle facilities fall into the following categories: fuel fabrication, fuel reprocessing, target fabrication, tritium recovery, target reprocessing, and waste management. The availability of associated codes and standards, specifications and procedures to assure quality products should also be specified.

INSTITUTIONAL ACCEPTABILITY

There are numerous institutional factors that can and will be considered before the NPR design concept is selected. For the purposes of this evaluation process the major institutional factors to be assessed are the potential for contributions to the advancement of nuclear (reactor, safety, environmental) technology, the implications of the duality of technology and sites, any public acceptance considerations relating to the reactor technology, and the impact of the sale of by-product steam or electric power.

1. Advancement of Reactor, Safety, and Environmental Technology. A determination should be made of the benefits to nuclear technology associated with the design, construction, and operation of the technology. This would include advancing the state-of-the-art in nuclear technology design, and nuclear powerplant operation, and the subsequent spinoff potential for enhancing the nuclear power industry. For example, designs should be considered that provide for inherent and passive safety approaches; the application of robotics, artificial intelligence and expert systems, advanced control systems, and advanced sensors; the maintenance of a nuclear reactor development infrastructure in the US; reduced environmental impacts; and enhanced reliability of nuclear plants.

2. Duality. The concept of duality, i.e., to have redundancy and diversity of reactor technologies at one or more sites to produce weapons materials, could provide further assurance of production and should be assessed in view of the reactor technologies under consideration. Also, multiple units of a single technology at a single site should be considered where the aggregate output exceeds tritium goal amounts, e.g., three units sized at 50% of goal. Capacity flexibility, such as the reactor flexibility to produce 125% of goal quantities of tritium, without encountering significant risk to the timely completion of assured production should be addressed.

3. Public Acceptance. For the purpose of this evaluation, the public acceptance aspects addressed should be those uniquely associated with each technology.

4. By-product Steam/Electric Power. The ability of the technology to produce high-quality steam for electric production should be evaluated. This evaluation should consider (1) the production concerns, such as, potential impacts on the optimum production of tritium; (2) the long term implications of a heat dump to handle 100% of the steam load in the event electricity is not needed or the turbine generator is out-of-service; and (3) the impact of the sale of steam or electric power.

February 24, 1988

TECHNOLOGY EVALUATION CRITERIA FOR THE ENERGY RESEARCH ADVISORY BOARD STUDY OF THE NEW PRODUCTION REACTOR TECHNOLOGIES

Listing of Criteria

SUMMARY

The NPR will be required to produce goal quantities of tritium at the earliest possible date and, thereafter, in an assured, sustained, safe, and environmentally and institutionally acceptable way.

Given this goal, the NPR technology evaluation criteria are:

- Ability to produce goal quantities of tritium on a timely schedule. (Technology Base)
- Ability to meet safety and environmental requirements. (Safety & Environmental)
- Assurance of the availability of reactor, fuel, target, and processing technology for full-scale production on an urgent schedule with low schedule risk. (Project Schedule)
- Ability to meet the goal in a cost effective manner. (Project Costs)
- Availability of personnel; material; and development, test, and manufacturing facilities necessary to design, develop, manufacture, construct and operate the NPR. (Industrial Base)
- Contributions to the advancement of nuclear technology; the implications of duality, public acceptance, and the impact of the sale of steam or electric power. (Institutional Acceptability)

1. Technology Base

Status of technology base and R&D requirements for tritium production to design, construct, and operate the reactor and fuel cycle facilities and to meet regulatory requirements in lieu of licensing.

1.1 Tritium Production Status and R&D
    1.1.1 Reactor and core design (Target Implications)
    1.1.2 Target design
    1.1.3 Target experiments/demonstration
    1.1.4 Target fabrication
    1.1.5 Tritium recovery
    1.1.6 Target reprocessing
    1.1.7 Target waste management

1.2 Specific Tritium Production Criteria
    1.2.1 Production rate
    1.2.2 Efficiency of Production
        kg per MW
        kg per $
        kg per person-rem - operating
        kg per person-rem - public
    1.2.3 Operational experience
    1.2.4 Reliability/availability
    1.2.5 Sprint/surge capability
    1.2.6 Performance at less than design power
    1.2.7 Complexity of process

1.3 Plutonium Conversion Option
- 1.3.1 Capability to convert from tritium production
- 1.3.2 Production rate
- 1.3.3 Operational experience
- 1.3.4 Reliability/availability
- 1.3.5 Complexity of process
- 1.3.6 Product Quality

1.4 Reactor and Fuel Cycle Status and R&D
- 1.4.1 Reactor systems and component designs
- 1.4.2 Systems and equipment testing
- 1.4.3 First-of-a-kind systems and components
- 1.4.4 Fuel fabrication
- 1.4.5 Fuel reprocessing
- 1.4.6 Waste management
- 1.4.7 Mitigation systems
- 1.4.8 ECC assurance (experimental and analytical)
- 1.4.9 BOP feedback
- 1.4.10 Reliability/availability/maintainability/inspectability
- 1.4.11 External hazards

1.5 Regulatory and Safety Status and R&D
- 1.5.1 Criteria, guides, review plans
- 1.5.2 General design criteria
- 1.5.3 Analytical capabilities
- 1.5.4 Experimental programs
- 1.5.5 Validation/peer review
- 1.5.6 PRA

2. Safety and Environmental

Provides for the health and safety of the public and workers, and assures the ability of the technology to provide reactor safety and environmental protection aspects at least equivalent to those for present commercial reactors/fuel cycle facilities.

2.1 Safety Goals
- 2.1.1 Latent cancer fatalities
- 2.1.2 Early fatalities
- 2.1.3 Large release

2.2 Inherent Safety Features
- 2.2.1 Low Power densities
- 2.2.2 Low internal energy, e.g., low temperature, low pressure, etc.
- 2.2.3 Negative reactivity temperature coefficient
- 2.2.4 Passive decay heat removal

2.3 Enhanced Safety Features
- 2.3.1 Redundant and diverse components/systems/functions
- 2.3.2 High reliability components
- 2.3.3 Safety margins
- 2.3.4 Engineered safety features for severe accidents
- 2.3.5 Containments
- 2.3.6 Accommodates anticipated transients without scram (ATWS) events without damage

- **2.4 Low Source Term**
    - 2.4.1 Minimize accident consequences
    - 2.4.2 Emergency planning
    - 2.4.3 Public Risk perceptions
    - 2.4.4 Containment requirements

- **2.5 External Events**
    - 2.5.1 Seismic hazards
    - 2.5.2 Floods
    - 2.5.3 Fires
    - 2.5.4 High winds
    - 2.5.5 Malevolent acts

- **2.6 Severe Accident Potential**
    - 2.6.1 High enriched fuel
        - Fabrication
        - Reprocessing
    - 2.6.2 Core Damage Accidents

- **2.7 NRC Regulatory Requirements**
    - 2.7.1 10 CFR
    - 2.7.2 General design criteria
    - 2.7.3 Severe accident policy statement
    - 2.7.4 Standard review plan
    - 2.7.5 PRA/DBA
    - 2.7.6 Defense-in-depth

- **2.8 Safeguards and Security**
    - 2.8.1 Reactor complex
    - 2.8.2 Fuel cycle facilities
    - 2.8.3 Transportation
    - 2.8.4 Materials control and accountability

- **2.9 Target and Fuel Cycle Safety**
    - 2.9.1 Occupational exposures - ALARA
    - 2.9.2 Industrial safety
    - 2.9.3 Toxicology
    - 2.9.4 Fire Safety

- **2.10 Operating Releases**
    - 2.10.1 Radioactive
    - 2.10.2 Hazardous
    - 2.10.3 Heat

- **2.11 Waste Management**
    - 2.11.1 Radioactive
    - 2.11.1 Hazardous
    - 2.11.1 Mixed

3. Project Schedule

Assurance of reactor, fuel, target, and processing technology availability for full-scale production on an urgent schedule with low schedule risk.

- **3.1 Safety/Environmental/Regulatory Schedule**
    - 3.1.1 Safety goal criteria
    - 3.1.2 Preliminary safety analysis/PRA
    - 3.1.3 Safety evaluation (Oversight)
    - 3.1.4 Draft environmental impact statement - site considerations
    - 3.1.5 Final safety analysis and environmental impact statement

3.2 Technology R&D Schedule
3.2.1 Experimental programs
3.2.2 Analytical models
3.2.3 Equipment testing
3.2.4 Validation of capabilities
3.2.5 Peer review

3.3 Design Schedule
3.3.1 Title I and II
3.3.2 Design basis approach/PRA

3.4 Construction Schedule
3.4.1 Vendor experience
3.4.2 A-E experience
3.4.3 Constructor experience
3.4.4 Industrial base
  - personnel
  - material
  - manufacturing facilities

3.4.5 Constructability
3.4.6 Modularity

3.5 Startup and Operation Schedule
3.5.1 Testing
3.5.2 Training
3.5.3 Operational standards/procedures

4. Project Costs

Provides for the production of goal quantities of tritium in a cost effective manner with a high assurance of success. The principal factors related to the NPR complex to be addressed are the preoperational costs, capital facility costs, operating and maintenance costs, including fuel and target, and potential offsetting revenues. For the purposes of this evaluation, the NPR complex is defined as, the new production reactor, and, if appropriate, the steam/electric power conversion system, the fuel fabrication facility, the target fabrication facility, the fuel reprocessing facility, the tritium recovery facility, and the target reprocessing facility.

4.1 Preoperational Costs
4.1.1 Tritium production R&D and testing
4.1.2 Reactor and fuel cycle R&D and testing
4.1.3 Regulatory and safety R&D and testing
4.1.4 Pre-title I design and engineering
4.1.5 Regulatory, safety, environmental activities
4.1.6 Test operations and startup
4.1.7 Operations, maintenance, and testing procedures
4.1.8 Project Management and administration

4.2 Capital Facility Costs
4.2.1 Design, engineering, and inspection (Title I, II, and III)
4.2.2 Construction
4.2.3 Equipment and component procurement
4.2.4 Initial spares
4.2.5 Initial NPR fuel loading
4.2.6 Project management and contingency

4.3 Operating and Maintenance Costs, Including Fuel and Target
4.3.1 Operations and maintenance
4.3.2 Component replacement and operating spares

- 4.3.3 Engineering and technical support
- 4.3.4 Training
- 4.3.5 Fuel
- 4.3.6 Targets
- 4.3.7 Waste Management
- 4.3.8 Decontamination and decommissioning

4.4 Revenues
- 4.4.1 Sale of steam/electric power

4.5 Production Rates
- 4.5.1 Annual tritium production (classified)
- 4.5.2 Annual Steam/electric power production
- 4.5.3 Value of steam/electric power

5. Industrial Base

The extent to which an industry and its infrastructure can mobilize intellectual personnel, material resources, and facilities to design, develop, manufacture, construct, and operate the NPR.

5.1 Personnel
- 5.1.1 Engineering
- 5.1.2 Safety analysts
- 5.1.3 Designers
- 5.1.4 Construction
- 5.1.5 Operators
- 5.1.6 Maintenance
- 5.1.7 Management

5.2 Materials
- 5.2.1 Nuclear fuel
- 5.2.2 Target material
- 5.2.3 Other strategic and special materials

5.3 Development and Test Facilities
- 5.3.1 Fuel and Target Irradiation Tests
- 5.3.2 Thermal Hydraulic Tests
- 5.3.3 First-Of-A-Kind Component Tests

5.4 Manufacturing Facilities
- 5.4.1 Component fabrication
- 5.4.2 Standards, specifications, procedures, etc.

5.5 Fuel Cycle Facilities
- 5.5.1 Fuel fabrication
- 5.5.2 Fuel reprocessing
- 5.5.3 Target fabrication
- 5.5.4 Tritium recovery
- 5.5.5 Target reprocessing
- 5.5.6 Waste management facilities
- 5.5.7 Standards, specifications, procedures, etc.

6. Institutional Acceptability

For the purposes of this evaluation process, the major institutional factors to be assessed are the potential for contributions to the advancement of nuclear technology, the implications of duality of technology and sites, any public acceptance considerations relating to the reactor technology, and the impact of sale of steam/electric power.

- **6.1 Advancement of Reactor, Safety, and Environmental Technology**
  - 6.1.1 Inherent and passive safety approaches
  - 6.1.2 Application of:
    - robotics
    - AI/expert systems
    - control systems
    - advanced sensors
  - 6.1.3 Infrastructure
  - 6.1.4 Reduced environmental impacts
  - 6.1.5 Enhanced reliability

- **6.2 Duality**
  - 6.2.1 Capacity flexibility, i.e., production goal plus 25 percent
  - 6.2.2 Redundancy/diversity of reactor technologies
  - 6.2.3 Duality of sites

- **6.3 Public Acceptance**

- **6.4 By-Product Steam/Electric Power**
  - 6.4.1 Production concerns, e.g., impact on nuclear materials production assurance and optimum output
  - 6.4.2 100 percent heat-dump (long term)
  - 6.4.3 Impact of the sale

2/26/88

TENTATIVE SCHEDULE OF ERAB NPR ACTIONS

March 1, 1988	Submit Interim Report to the Secretary
March 1-11	Subpanel Meetings (Albuquerque, Germantown, & Boston)
April 19-20	Second Panel meeting, Los Angeles (The meeting on the 19th will begin at 2 pm)
May 24	Third Panel meeting, Washington
June 13-15	ERAB Meeting at Lawrence Livermore National Laboratory. The Board will review its Final Report on June 13
July 1	ERAB submits its Final Report to the Secretary

ADDITIONAL QUESTIONS SUBMITTED FOR INCLUSION IN THE RECORD

Senator McClure. Thank you, gentlemen, very much. Thank you for your attention and your willingness to testify here today.

As has been mentioned, Senator Hatfield, Senator Johnston, and I will have some additional questions which will be made part of the record at this point for your response.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR JOHNSTON

Hearing on the New Production Reactor (NPR)

Question: It was agreed that assurity of production goals with maximum consideration of safety is the principal criterion of selection. It was stated that neither time to reach production level nor cost were discriminators for selection. Please supply available data on schedule and cost (capital and life cycle, with and without power production) for each concept to substantiate the assertion.

Answer: The Energy Research Advisory Board (ERAB) report contained four findings relative to cost and schedule:

"Each of the reactor types considered can meet the mission requirements of a NPR with varying degrees of risk as to cost and schedule.

"The HWR presents the least schedule risk because of the existing facilities, personnel, and experience at Savannah River. Given at least ten years to achieve full production status, all candidates could meet the schedule.

"A HWR, being a low temperature reactor with no production of steam or electricity, would have the lowest initial cost of any new NPR. The other technologies offer the possibility of revenues from energy sales that, in some circumstances, could offset a significant fraction of the NPR costs.

"Conversion of the partially completed WNP-1 reactor to nuclear materials production is a special case of the LWR technology. It offers the possibility of a shorter schedule and lower initial cost than a NPR. Safety and environmental aspects would be comparable to those of present commercial LWRs. Target development similar to the SWR is required for the WNP-1, and the cost and time required to obtain public acceptance of conversion of a "commercial" reactor and to implement legal processes to acquire the reactor are uncertain."

Cost information was previously supplied in the DOE report "NPR Capacity Cost Evaluation," DOE/DP-0052.

In addition, ERAB noted the following options are available:

If there is a need for full tritium production as early as possible, then options are limited to the HWR and WNP-1 conversion. The HWR appears to have the best chance of quickly providing the needed capacity because of the existing facilities, personnel, and experience at Savannah River. The ERAB recognizes that the WNP-1 may provide a unique opportunity for conversion to tritium production at relatively low capital cost while providing some revenues from the sale of steam. However, there are schedule risks because of the need to demonstrate an adequate target technology, uncertainties of public acceptance of conversion to defense purposes, and possible delays because of the legal processes required to acquire the WNP-1 facility.

Question: What are the criteria to judge assurity of production?

Answer: The following is the relevant excerpt from the set of technology evaluation criteria used by both ERAB and the DOE during the NPR technology selection process.

"TECHNOLOGY EVALUATION CRITERIA

The NPR will be required to produce goal quantities of tritium at the earliest possible date and, thereafter, in an assured, sustained, safe, and environmentally and institutionally acceptable way.

Given this goal, the NPR technology evaluation criteria are:

o Ability to produce goal quantities of tritium on a timely schedule. (A. Technology Base)..."

"TECHNOLOGY BASE

This category evaluates the maturity of the technology and addresses the technology base for the NPR. For each reactor concept under consideration the current and any required upgrading of the technology base should be assessed. The status of the technology and required R&D should be identified for tritium production; conversion to plutonium production if this option were to be exercised; reactor design, construction, and operation; fuel cycle facilities design, construction, and operation; and regulatory and safety activities. 'Regulatory' is defined as those compliance activities stemming from regulations issued by NRC, DOE, EPA and other Federal, state and local agencies.

1. Tritium Production Status and R&D. The reactor and core design, target design, the results of any in-pile testing, target fabrication and reprocessing, tritium recovery techniques, as well as any unique target or fuel waste management schemes should be evaluated. Tritium production is the central feature of the NPR. Examples of specific criteria relating to this aspect which should be considered are production rate, efficiency of production (KG per MW, KG per $, KG per Man-REM - Operating, KG per Man-REM - Public), operational experience, reliability/availability/maintainability/inspectability, sprint/surge capability, tritium production performance at less than design reactor power, and the overall complexity of the production process.

2. Plutonium Conversion Option. The following factors should be addressed under this criterion: the flexibility and capability of the design to convert from tritium to plutonium production; the expected production rate subsequent to such conversion; any pertinent operational experience; the impact of conversion on the reactor in terms of reliability/availability/maintainability/inspectability; the complexity of the conversion process and the time required to accomplish it; and the quality of the plutonium.

3. Reactor and Fuel Cycle Status and R&D. System and component designs and the results of and the requirements for both out-of-pile

and in-pile testing should be considered. In addition, custom-designed or first-of-a-kind systems and components identified by the proponents should be addressed. The fuel fabrication and reprocessing technology to be used should be addressed along with the proposed associated waste management approaches. Accident mitigation systems and the results of any experimental and analytical work done on proposed ECC systems should be evaluated. Any potential damaging feedback from the balance of plant (BOP) should be considered. The NPR complex should be evaluated in terms of reliability/availability/maintainability/inspectability, and the potential impacts on the complex from external hazards.

4. Regulatory and Safety Status and R&D. The status of the safety criteria, guides, and general design criteria applicable to the technology under consideration should be evaluated and upgrades for the given technology identified. The availability of the necessary analytical skills and the status of supporting experimental programs should be addressed. The effort required for validation and for the peer reviews for assuring that the safety goals are in fact being met should be identified. The status of these reviews should also be taken into account. The status of PRA experience, technology and the related data base should be assessed..."

Question: What are the criteria for safety discrimination among the concepts and sites?

Answer: The top-level technology evaluation criteria for safety and environmental used by both ERAB and the DOE during the NPR technology selection process were:

"Ability to meet safety and environmental requirements. (B. Safety & Environmental)..."

This criterion provides for the health and safety of the public and workers, and assures the ability of the technology to provide reactor safety and environmental protection at least equivalent to those for present, commercial reactors and fuel cycle facilities. Safety related factors to be considered include safety goals, inherent and enhanced safety features, the extent of the source term represented by the technology, external events, the potential for severe accidents, Nuclear Regulatory Commission (NRC) regulatory requirements, safeguards and security, and target and fuel cycle safety. Environmental factors that relate to operating releases and waste management should be addressed.

More specific sub-criteria are:

1. Safety Goals. The ability of the technology to comply with the NRC's safety goals should be assessed with respect to early fatality and latent cancer criteria and the probability of a large release. (During the conduct of the project, the ability of the preferred NPR technology(ies) to meet the NRC safety goals will be established by an independent safety review group.)

2. Inherent Safety Features. Inherent safety features should be identified such as a low power density in the core; low internal energy (low temperature, low pressure, etc.); negative reactivity void, doppler, and temperature coefficients; and the ability to

dissipate decay heat in a passive mode upon loss of all active components resulting from an event such as a station blackout (walkaway capability).

3. Enhanced Safety Features. The inclusion of enhanced safety features should be noted. This includes redundant and diverse components, systems, and functions; highly reliable components; significant safety margins; passive engineered safety features for severe accidents; containments; and features that accommodate Anticipated Transients Without Scram events without damage. It is important to note that a containment structure will be required for the NPR.

4. Low Source Term. Postulated source terms can have a major impact on the containment design and isolation capabilities and the perception of risk to the public. A low level of fission product source term following the most severe core meltdown accidents would minimize accident consequences, simplify emergency planning, and reduce containment requirements.

5. External Events. Any unique reactor or system design characteristics that would make the plant vulnerable to external events such as seismic hazards, floods, fires, high winds, and malevolent acts should be identified.

6. Severe Accidents Potential. Because of the high fuel enrichment used in most production reactor concepts, there is a potential for severe accidents. This includes criticality and recriticality following a disruption of certain phases of fuel fabrication or reprocessing, and following an event that damages the core. These accidents should be carefully assessed.

7. NRC Regulatory Requirements. Consideration should be given to the intent of NRC requirements for commercial reactors using the 10 CFR guidelines such as, 10 CFR 50 Appendix A (the General Design Criteria); the Severe Accident Policy Statement; the Standard Review Plan; and the evolving advanced reactor policy. Existing Probalistic Risk Assessment should be used to estimate compliance with the safety goals noted above. The identification of design basis accidents, and the use of a defense indepth approach for the proposed concept should also be addressed.

8. Safeguards and Security. Safeguards and security take on added importance in a production reactor complex. Any unique reactor design or process feature which would either enhance or detract from the security or safety of the reactor complex fuel cycle facilities, transportation facilities, and/or materials control and accountability should be identified.

9. Target and Fuel Cycle Safety. Unique target and fuel fabrication and reprocessing characteristics, and tritium recovery characteristics that would reduce occupational exposures As Low As Reasonably Achievable, and the potential for toxic releases that would enhance industrial and fire safety should be considered.

10. Operating Releases. The level of normal operating releases should be addressed, such as, the level of radioactive gaseous or liquid effluent released to the environment during routine operation

of the NPR complex. The level of hazardous effluents released to the environment, and the amount of heat rejected during normal operations and its effect on the environment surrounding the plant should also be addressed.

11. Waste Management. The amount of low, medium, and high level radioactive, hazardous, and mixed wastes generated during the expected life of the reactor could have a significant impact on the safe operations of the complex and the cost of operations. Requirements for onsite facilities for processing, packaging, storage, disposal, and transportation should be evaluated..."

Question: If WNP-1 conversion to NPR is undesirable on the basis of non-proliferation (use of civilian reactor technology for weapons material production), does it necessarily follow that if the HTGR is selected for NPR that it ceases to be a candidate for civilian use by the utility industry?

Answer: In the evaluation of candidate technologies for the NPR, the DOE considered the major institutional factors that might affect public acceptance of the facility. One element in this category, particularly with respect to WNP-1, was the possibility that the public might view the use of WNP-1 as an NPR as an example of mixing defense activities with civilian activities, since WNP-1 was originally designed and constructed as a civilian reactor. The Departments review of this issue resulted in a conclusion that there are no treaty or legal reasons pertaining to nonproliferation that would prevent acquisition of WNP-1.

Clearly, the use of high-temperature gas-cooled reactors (HTGR) technology for an NPR is not encumbered by nonproliferation issues. Reactor technologies in themselves transcend the civilian defense barrier as has the light water reactor technology used by the nuclear submarine fleet and the U.S. commercial nuclear power plants.

Question: Is there a connection between the NPR and the proposed advanced reactor program? If so, what? Will the site selection be affected by this program?

Answer: The Office of the Deputy Assistant Secretary for Civilian Reactor Development is supporting research and development (R&D) programs for light water reactors, modular high-temperature gas-cooled reactors (MHTGR), and Liquid Metal Reactors. There is a connection between these programs and the DOE programs directed toward the design of the NPR. Cognizant NPR personnel have been fully informed of the scope and details of these programs, and this has been considered in the definition of near-term R&D programs in support of the NPR design. In particular, the results of MHTGR safety and design R&D activities currently under way in the civilian program will have a direct bearing on the development of the design requirements for the MHTGR NPR, and these results will be communicated to the cognizant NPR personnel.

Question: It was implied that the level of design maturity among the concepts was highest for the HTGR. Yet it seems we have thousands of operating years of LWR operating experience. Many more years of licensing experience. What is the level of design maturity among the concepts?

Answer: The level of design maturity among the four concepts follows:

Light Water Reactor (LWR)

The LWR incorporates the most widely used nuclear technology for power production available today. The technology includes an extensive background of experience in design, licensing, equipment fabrication, construction and operation infrastructure. However, there is no production level operating experience with LWR tritium targets. Target technology requires development and qualification testing.

Heavy Water Reactor (HWR)

The HWR technology has accumulated over 130 reactor years of operating experience in tritium and plutonium production at the Savannah River Plant (SRP). The HWR has not had experience with current safety and environmental review processes equivalent to that provided by the NRC.

Modular High-Temperature Gas-Cooled Reactor (MHTGR)

The MHTGR technology has limited design, construction, licensing and operating experience in the United States. The modular concept offers a variety of inherent safety features and flexibility in operation, but the concept must be further developed into a detailed design. Target technology is at an advanced stage of development, requiring verification and qualification testing.

Liquid Metal Reactor (LMR)

The LMR technology has had good, but limited, operating experience in the United States. The licensing type of experience has been with the Fast Flux Test Facility (FFTF) and the Clinch River Breeder Reactor (CRBR). The LMR has no proven target technology or tritium target system; research, development and qualification testing would be required.

Question: What is the status of the US vendor industry to respond to the demands of the NPR schedule? Is there an existing infrastructure to supply parts and components for each concept, equally?

Answer: The U.S. industrial base, particularly the personnel and manufacturing facilities infrastructure, should be able to handle the requirements of a HWR/NPR, but with some impact on the overall schedule of the project. From a materials, components, and systems viewpoint, these reactors are similar to the large LWR's that dominate the U.S. civilian nuclear electric power scene. One can expect some transitional delays with a medium impact on the schedule risk. The U.S. industrial base, particularly the personnel and manufacturing facilities infrastructure, is in place to handle the design, development, construction and operational requirements of an LWR/NPR or WNP-1 on an urgent schedule basis. Reactor manufacturers have retained personnel through a resupply service and major LWR plant retrofit and modification programs. Low schedule impact is seen for this discriminator.

An LMR has not been constructed in the United States since cancellation of the CRBR in 1984. At that time, a major portion of fabrication facilities in the United States were identified and major components had been fabricated. To bring the U.S. industry to this state of readiness, a mobilization-type activity was put in place in which existing fabricators were trained to carry out the special operations to fabricate LMR components. A major part of this capability was disassembled when the CRBR project was cancelled in 1984. It should not be difficult to marshal these forces in the future, but it will take some time, funding and training. This would introduce a high degree of risk in the LMR schedule when compared to the status of the LWR industry.

An HTGR has not been constructed in the United States since Fort St. Vrain in 1972. There is some concern whether there is a sufficient cadre of experienced HTGR design engineers, although with some delay, available LWR design personnel could be retrained. Fuel and vessel fabrication capability is available. In view of the possible need to retrain personnel and to organize and activate all necessary facilities, the HTGR has significant schedule uncertainty relative to the need to meet an urgent schedule and relative to the LWR industry.

Question: What is the status of the licensability of each concept? Does the presence of target material in the reactor affect the risks associated with licensability, equally?

Answer: The LWR has served as the basis for development of the U.S. licensing process. A major portion of the technical rules, regulations, and guides have been developed as a result of the review and analysis of LWR industry reactors. (In this answer, we are using as the definition of licensability, "the capability of being licensed by the U.S. NRC from the technical viewpoint alone"). Given this definition, the LWR is obviously quite licensable.

The HWR has been subjected to one licensing review, i.e., the Carolinas-Virginia Test Reactor in the midsixties and early seventies. Additionally, a number of the production reactors, including the N Reactor, have been reviewed by NRC technical groups, as well as the Advisory Committee on Reactor Safeguards. A large proportion of the regulatory guides and technical rules should be applied with ease to the HWR since many of the technical bases for materials, codes, manufacturing processes and operational approaches are shared with the LWR. The transferability of part of the LWR data base and the large amount of operating experience at SRP, which has provided verified confidence in the technology, allows one to anticipate licensability without unusual difficulty.

The HTGR program has been undergoing a structured interaction with NRC to address the question of eventual licensability should a reactor plant be proposed and brought into NRC for a full-scope licensing review. An analysis of the applicability of the existing technical basis for licensing has been conducted. This, along with probabilistic risk assessments (PRA) and preliminary safety evaluation reports, has been utilized by NRC to generate a set of licensing criteria against which licensing applications of the future would be judged. Licensability has not been demonstrated, but criteria and methods have been identified which, when exercised, should allow the plants to be licensed given the conduct of R&D programs and full-plant testing. A similar program has been conducted for the LMR.

As to the matter of influence of target material in the reactor on the risks associated with licensability, we do not believe that the impact will be equal. Early HWR reviews included the conduct of reactor operations with targets of various kinds in the reactor core. No such reviews for licensability purposes have been conducted for HTGR's, LWR's or LMR's.

Question: Why were the safety analysis tools (procedures, codes, etc.) for the HWR judged to be four years behind the other concepts? If the NRC has licensed two gas reactors and over 100 water reactors, do not most of the procedures and analysis codes directly apply to the HWR from the LWR?

Answer: The SRP reactors, in their 30 years or more of operation, have accumulated an enviable record of safe operation. During accumulation of this record, the civilian nuclear power industry was born and the licensing process was evolving along with the growing industry. In the mideighties it became apparent that a number of safety codes and safety approaches used by the civilian reactor industry were not in use at SRP. Since that time, a considerable effort has been put in place to select and modify those tools and procedures which would contribute to improved SRP reactor safety. As the question implies, a significant portion of the codes was found to have general application to the HWR. However, for specific application, modifications to the codes must be made so they can be directly utilized in existing reactor operations.

Question: Senator McClure stated and it was not denied by DOE that no target experimental data are available for the LWR? Is this true? What is the status of target development and the associated reprocessing requirements for each of the concepts? What are the relative costs?

Answer: DOE has been supporting a target development program for the LWR technology, including N Reactor, for several years; specific results of this program are classified. The feasibility has been generally demonstrated. Further confirmatory testing, optimization studies, and large-scale manufacturing feasibility remain to be completed.

The HWR has the most mature target technology of all concepts, and no target development work is anticipated. The MHTGR target technology development is at an advanced stage, but still requiring verification and qualification testing. A three to four year program for MHTGR target qualification is estimated to cost about $50 million. The LWR target technology has demonstrated feasibility, but requires further development and qualification testing. A LWR target R&D program is now estimated to cost $94 million. Target technology for the LMR is at an early stage of development. A 3-year target R&D program, including qualification testing in the FFTF would cost approximately $20 to $30 million plus the costs associated with the use of the test facility.

Question: Define the NRC conditions of Class 9 accidents. Have solutions for the prevention of this condition been proposed by all concepts? Are all designs using passive safety techniques?

Some of you will recall that I've consistently urged the Department to utilize the NPR procurement not only as a way to replace the aging production reactors at Savannah River, but also as a means to introduce new passively safe modularized nuclear plants to the marketplace. In March I was told the various technologies were considered essentially equal. Now the ERAB report appears to favor the Heavy Water Reactor. I hope that we're not at the end of the road in the process and that we don't miss the opportunity to do something about civilian nuclear power. We're all worrying, with cause, about global warming and pending energy shortages. Since there is no commercial application of the heavy water reactor, in my mind, it is even more critical to use a modular passively safe technology for the NPR, particularly since the new technology can contribute in reducing the global warming problem. What are your thoughts?

Answer: Traditional NRC Class 9 accidents represent those accidents that involve failures not considered in the design basis of the facility. Thus, any accident that goes beyond the design basis is considered a Class 9 accident. Since reactors are designed to prevent the design basis accidents, any accidents in which the reactor fails to maintain critical safety function such as adequate core cooling are considered Class 9 accidents. Core melt accidents are considered Class 9 events. PRA techniques are used to investigate the progression and impact of these accidents. All of the NPR concept proponents committed to use PRA techniques in the development and implementation of the NPR designs. In addition, whenever applicable and cost-effective, passive safety techniques were incorporated into the proposed NPR concepts. Detailed designs are not complete for any of the concepts, but prevention of severe accidents will play a major role in the design criteria for all concepts. Passive safety techniques will also be included in the detailed design efforts wherever applicable and cost effective.

The strategy recommended by Secretary John S. Herrington for the acquisition of NPR capacity involved two technologies: an HWR at Savannah River and an MHTGR at the Idaho National Engineering Laboratory. By this action, the DOE has considered the benefits to the nuclear industry by the recommendation of a technology that utilizes modular design and inherent passive safety features. Clearly, a vigorous nuclear industry with renewed interest in nuclear electricity will contribute to solving the global warming problem. However, the primary purpose of the NPR is to provide an assured source of tritium on an urgent schedule and in a safe manner. The HWR designs are characterized by inherent safety features such as passive decay heat removal and low temperature and pressure operation.

QUESTIONS SUBMITTED BY SENATOR HATFIELD

Hearing on the New Production Reactor (NPR)

Question: The recent report of the Energy Research Advisory Board (ERAB) has raised serious questions about the Department of Energy's ability to demonstrate and certify new tritium target and recovery technologies for Light Water Reactors (LWR) in the near-term. In fact, the ERAB report stated, and I quote, "The main schedule risk for the LWR stems from uncertainties in target technology and the potential need to develop and qualify the selected target configuration in an operating LWR, a process that could take as much as four years to complete." (ERAB Report, p. 23) Does DOE, today, have demonstrated tritium target and recovery technologies for LWR's, in particular WNP-1 at Hanford, which will assure that goal quantities can be met and if not when will those technologies be demonstrated and certified?

Answer: The Department of Energy (DOE) does not today have in hand fully demonstrated tritium target and recovery technologies for WNP-1 at the Hanford site. If fully funded at the requested level, the conversion program, including the target work, would be brought to completion in about 5 years.

Question: The United States, since the very inception of our atomic energy and Atoms for Peace programs, has maintained a strict separation between our civilian and military programs and with good reason. Even though we are a nuclear weapons state, we have wanted to abide by the same non-proliferation limitations that we hope other nations will honor and we do not want the export of our civilian technologies or their development here at home to run afoul of public and international concerns about nuclear proliferation. It seems to me that the control of the proliferation of nuclear weapons and technologies around the world is every bit as important to our national security as maintaining our own nuclear arsenal. Given this long-standing U.S. policy, how can we defend taking a nuclear powerplant that ratepayers in my state and in the Northwest have paid $2 billion dollars to build, which was issued a construction permit by the Nuclear Regulatory Commission as a civilian powerplant, and converting it to a defense production facility?

Wouldn't we be outraged if a developing nation did this? And wouldn't this action limit our ability to convince other nations to prohibit the use of their civilian nuclear programs for weapons production?

Answer: In the evaluation of candidate technologies for an NPR, the Energy Research Advisory Board, and independently DOE, considered the issue of the public acceptability of the technology. With respect to the Washington Public Power Supply System's WNP-1 nuclear project, the evaluation process considered issues such as the acquisition of title, financing, and the public perception regarding appearance of mixing defense activities with civilian activities. It has been concluded that there are no treaty or legal reasons pertaining to nonproliferation that would prevent acquisition of WNP-1. However, these issues and those you have identified will be deliberated in the Department's activities on solving the institutional issues associated with the acquisition of the WNP-1 reactor at the Hanford site.

QUESTIONS SUBMITTED BY SENATOR McCLURE

Hearing on the New Production Reactor (NPR)

Comment to Joe Salgado: Over the past few years, in your role as Under Secretary of Energy, you have had to appear before Congressional hearings many times. Many times you have had to account for serious problems with DOE/AEC actions taken in the past. Every time there has been a large scale attack on the Department--and I am thinking specifically about the NAS report on defense reactors and the $100 billion clean-up cost of the DOE facilities--you have had to bear the brunt for decisions that were not made "on your watch". I want to say today that I hope this hearing can provide you with an opportunity to help someone else who will be sitting in your chair 10 to 20 years from now, to prevent serious problems from arising in the future. So I urge you to make very careful and judicious use of the ERAB report as well as the information that comes from this hearing and from other sources.

Question: I hope you have read the ERAB report as carefully as I have, because I want your reaction to my conclusions concerning the technology options considered in the report:

a. The LMR is probably not a contender because of the lack of tritium target development, the relative immaturity of production design concepts, and the paucity of industrial infrastructure.

b. The LWR is not a near--term option because of the need for at least 4 more years of target development work, and the hazy line that selection of this technology would draw between commercial and military applications.

c. The conversion of WNP-1 (also a LWR) is not practical nor prudent, in spite of some good marks it received in the ERAB report. I say this because of several considerations:

   - It would take at least 4 years to prove a target technology, and I assume DOE would not want to proceed with the conversion work until after the target has been verified.

   - The legal and institutional problems associated with WNP-1 conversion have not been addressed at all, and we don't even know if they can be resolved, let alone when they'll be resolved.

   - The quality assurance and operability questions associated with completing a plant that has been sitting "mothballed" for a decade have never been answered, and add unnecessary risk to the project.

   - The public perception problems associated with conversion of a commercial plant to military uses are potentially the worst problems you might have to face with respect to WNP-1 conversion.

- o Finally, there is a perception out there that WNP-1 conversion is being driven by politics instead of science. Who is pushing the conversion of WNP-1? (I know of at least one politician--the senior Senator from Oregon...who has publicly stated his objections to use of the WNP-1 reactor). I don't think I need to remind you that a decision on the future nuclear deterrence capabilities of this nation transcends politics, and must be driven purely by the right technological approach.

d. The advanced LWR (ALWR), while only mentioned briefly in the ERAB report, is only in its infancy, and again suffers from the same 4-year tritium target lag problem I've already mentioned.

e. A single, full-sized plant of any design suffers the vulnerabilities of "putting all your eggs in one basket" syndrome, so adeptly addressed in the ERAB's section on duality (see pp. 26-29).

f. Construction of all the capacity at a single site provides no protection from the sudden loss of capacity due to natural disasters, sabotage, or the likelihood that an accident at one reactor would shut down the entire site (as we have seen at Three Mile Island, where the "good reactor").

g. Construction of the entire capacity using a single technology does not insulate you from generic design flaws (thank goodness all the Savannah River reactors were not the same design as "C" Reactor, which is permanently shut down due to a design flaw in its pressure vessel) or a safety problem (such as the safety issue that now prevents us from operating the existing HWR plants at Savannah River above 45% power).

Answer: We generally agree with some elements of your observations and with the general conclusions you have reached.

Regarding your comments on WNP-1, the Department notes that there are potential cost and schedule advantages for converting to a production reactor. For this reason the Secretary has recommended..." As a further contingency, work should continue as target development for LWR and on solving the institutional association with acquisition of the WNP-1."

Question: All of the thought processes that I have just taken you through in the previous question leads me to one final conclusion, and that goes as follows:

The HWR and the HTGR are the only viable options, and each ought to be pursued at different sites in order to address diversity and duality issues. There would be some added costs for this scenario, but from a national security perspective, I don't see how we can afford not to choose this approach.

Now, if we can all agree that two reactors (HWR and HTGR) at two sites is the preferred, most assured route, then we need to decide how we can cut costs and schedules.

One obvious way to cut costs in this approach is to build each reactor at half the size of the total capacity required. (This will also keep the commitment intact to complete two reactors, because neither one by itself would supply sufficient quantities of nuclear materials).

Concerning schedules, I do not believe that any reactor technology has the edge on schedule, simply because there are too many factors beyond our control (safety verification, the EIS process, etc.), but we can condense the schedule as much as possible by building both reactor simultaneously. Now, you may question whether we can proceed with the HTGR at this time, given that two more years are needed to verify the tritium target design. But let me suggest the following approach:

It will take 2 years to do EIS, design work, and safety analyses for both the HWR and the HTGR. (The HWR is especially weak in the safety verification area). Meanwhile, HTGR target work could be completed within this same 2-year period. If the target work was successful, the construction of the HTGR could then begin on schedule. If the target work was unsuccessful, then DOE could withdraw its plans for an HTGR, and instead begin construction (at the second site) of a half-sized HWR, whose design work has already been completed during the first 2-year period. While this "fallback" option does not give us diversity of technologies, at least it does give us duality of sites and the certainly of full-scale tritium production capability in the shortest schedule possible.

What does the Department think of this approach?

Answer: Proceeding with half-size reactors jeopardizes the urgency to have on line as soon as practicable, new capacity to meet 100 percent of goal quantities of tritium.

Concerning the schedules, the HWR certainly has its institutional hurdles to overcome such as you noted in the safety verification area. The HWR technology, being so closely related to the commercial LWR systems, and the fact that the fuel and target technology, as well as all of the required supporting facilities are currently in place, should allow the HWR system to meet the schedule urgency. The MHTGR has similar institutional hurdles to overcome, and more importantly from an assured production viewpoint, not only must it successfully complete its target development program, but its circulator, steam generator fuel and graphite and other development activities as well. For the MHTGR to produce 50 percent goal quantities, a complete set of target fabrication and tritium recovery facilities must be developed, designed, and constructed.

In view of this situation, the principal program milestones for the deployment of new production reactor capacity are: (1) to provide a 100 percent capacity HWR at SRP ready to operate within 10 years of the contract award for design and construction, and (2) to provide the first module of a four-module MHTGR at INEL ready for reliability demonstration within 10 years of the contract award for design and construction. In addition, the Department has established the following major milestones as decision points for the continuation of program activities on the MHTGR: (1) successful completion of target and fuel technology research and development (R&D), (2) successful completion of reactor support R&D and (3) reliable operation of the first MHTGR module for a 1-year period.

Question: Could you describe to me in detail the nature of the decision making process from this point on, in terms of:

1. Timing of final decision

2. Input from outside sources (White House Science Advisor, Nuclear Weapons Council, DOD)

3. ESAAB (Energy Systems Acquisition Advisory Board) makeup and schedule of meetings

4. Input from NPR site evaluation team (when will this report be available?)

Would you keep me informed of the progress of this "decision" from time to time prior to the Secretary's announcement of his final decision?

Answer:

1. The acquisition of the new production reactor capacity will be reviewed under the National Environmental Policy Act process which includes the preparation of an Environmental Impact Statement (EIS). The final decision on technologies and sites will be made after completion of the EIS, which is scheduled to be in about 2 years.

2. In the course of its deliberations on technology selection and site evaluation, the Department engaged in consultations with several governmental agencies to obtain their views and recommendations regarding the acquisition strategy for replacement production capacity. The principal topics of concern were the requirements for assured supplies of tritium and plutonium, and the concept of duality. Consultations took place with representatives from the Department of Defense, the Office of Science and Technology Policy, the National Security Council, the Nuclear Weapons Council, and the Office of Management and Budget.

   These agencies fully supported the evaluation approach utilized by DOE. The acquisition strategy is consistent with the objectives and particular interests of each agency with respect to requirements for tritium and plutonium and production assurance. The consensus is that the achievement of production assurance on an urgent schedule and in a safe manner are the key elements in the acquisition strategy.

3. The Energy Systems Acquisition Advisory Board (ESAAB) held a series of meetings from March 1988 through July 1988 to review information related to the designation of preferred technologies and sites for new production reactor capacity. The ESAAB membership consists of the Under Secretary of Energy (Chairman) and the heads of all major offices within DOE.

4. The Site Evaluation Team report was issued on July 7, 1988.

Question: I hate to pursue this next line of questioning, but in view of the recent flap about contractor collusion in the Pentagon, I cannot avoid it:

1. Which reactor vendor is participating in the proposal to convert WNP-1 to a production reactor?

2. Does Westinghouse have a design proposal for an HWR under consideration?

3. Has Westinghouse proposed an LWR or an advanced LWR design for the NPR?

4. Is Westinghouse bidding on the operating contract for Savannah River? (Who else is bidding?)

5. How many government contracts had DOE awarded to Westinghouse over the last 3 years? How does this compare to other "major" contractors in terms of the number of contracts awarded to each of these "major" entities over the last 3 years?

Answer:

1. Westinghouse is the reactor vendor participating in the proposal to convert WNP-1 to a production reactor.

2. Neither Westinghouse nor any other proponent has a design proposal for an HWR under consideration by the Department. Westinghouse along with other organizations established for the technology presented to the ERAB their preliminary views of an HWR/NPR concept.

3. Neither Westinghouse nor any other organization involved in this technology have an LWR design proposal under consideration by the Department. Westinghouse, along with other proponents, presented to the ERAB their preliminary views of an LWR/NPR concept and some information on an advanced LWR design for the NPR.

4. Westinghouse was one of the bidders on the operating contract for Savannah River (SR). In a press release dated September 8, 1988, DOE announced that Westinghouse had been selected to be the new management and operating contractor at SRP.

5. Over the past 3 years, the Department has awarded 641 contracts to about 335 different large businesses. (This excludes small businesses, universities, grants, and cooperative agreement.) Of these contracts, 42 were awarded to Westinghouse; 27 to General Electric; 17 to Babcock and Wilcox; 13 to Science Applications International Corporation; 11 to Rockwell International; 12 to BBC Brown Boveri; and 10 to EG&G. Other large businesses awarded contracts have been awarded less than 10 contracts.

Question: If DOE should see no clear winner between the three HWR design concepts and the one HTGR design concept, would it consider issuing a Request for Proposals, and have the bidders submit more detailed proposals, thus allowing DOE to choose the best options based on more solid information on designs, costs, schedules, and other vendor commitments?

Answer: The Department is considering several options in developing a strategy for the Request for Proposals (RFP) leading to project definition. The option you have described is one currently under review by the Department.

Question: What does DOE intend to do to adequately address the safety concerns raised by John Ahearne's Advisory Committee on Nuclear Facility Safety in their July 12 letter to Secretary Herrington? The statement from that letter that I am referring to is as follows:

The safety criteria for design and construction of the New Production Reactor can have a significant impact upon cost and schedule if these criteria are ambiguous. In our view such criteria as "provide a level of safety that would meet or exceed that provided to the public by licensed commercial power reactors," or "at least equivalent to the safety provided...by the commercial sector" are not sufficiently precise. We believe that the Department needs a clear explanation of such terms and concepts and how they are to be applied.

Answer: At the present time, DOE is actively engaged in developing detailed design safety criteria which would apply to the NPR. We will have the criteria in place, reviewed, and agreed to prior to the release of an RFP.

Question: When was the last HWR of the type envisioned for a NPR built?

Answer: The last production HWR was completed at Savannah River in 1954. No HWR of the type envisioned for this NPR has been built. However, the reactor fuel and target technology base is available. In addition, the infrastructure to build and operate an HWR NPR is also available.

Question:

1. Please explain the way in which the ERAB report will be used in making the decision for new production reactor capacity.

2. Is the ERAB recommendation the final word on the technologies?

Answer:

1. The ERAB was asked by the Secretary of Energy to conduct a review and assessment of four nuclear reactor technologies being considered by the Department as candidates for the new production reactor capacity. The ERAB report presented a set of findings based on the indepth assessment process. This report was used by the Energy Systems Acquisition Advisory Board (ESAAB) as one of several inputs in its deliberations on the designation of preferred technologies and sites for new production reactor capacity. In addition to the ERAB report, the ESAAB also reviewed the technology evaluation criteria, the site evaluation criteria, the report from the Site Evaluation Team, cost evaluation reports, and the Office of Defense Programs strategies for the acquisition of new production reactor (NPR) capacity. The ESAAB designations provided the basis for the Department's recommended strategy for the acquisition of new production reactor capacity.

2. The final decision on new production reactor capacity technologies and sites will be made after completion of an Environmental Impact Statement, as required by the National Environmental Policy Act.

Question: The ERAB report states that their assessment is not based on current technology and specific detailed designs because such information was not uniformly available from the respective sponsors.

Doesn't this divergency in design status make it quite difficult to try to develop meaningful cost and schedule comparisons between the concepts? Doesn't this therefore weaken the conclusions of the report? (For instance, the conclusion that the HWR is the "fastest track" is severely weakened by the fact that the design and safety work on the HWR are the least well advanced of all.)

Answer: The divergency in design status makes it difficult to develop comparable cost estimates. The new production reactor capacity cost evaluation recognized this and conducted a comprehensive cost and schedule risk assessment to develop realistic comparisons on the proposed technologies. To do this three separate and independent approaches to the development of the data were employed. It should also be noted that it is not just the status level (detail) of the design itself that is important in cost estimating but also the extent of design definition. We have very high assurance that an HWR design utilizing the present SRP reactor fuel and target technology will produce the goal amount of tritium. Thirty, plus, years of experience have shown that this technology is workable. Major new items proposed for the new HWR are safety-related additions. The HWR also has a complete fuel and target cycle in place at the SRP, so the additional design needed for these facilities is expected to be minimal. More R&D and design work are needed on safety systems. However, that work will account for only a fraction of the total final design and construction cost.

The MHTGR does not yet have the years of operating experience that prove, with required reliability, that the design is workable, and the tritium production goals will be met. The MHTGR will be a first-of-a-kind item based on modular reactor manufacturing technology and a new fuel/target cycle never used for tritium production. The present design may be detailed, however, the design for a new process or technology is subject to many scope and design changes over its development and construction life cycle. These changes have a significant probability to impact cost and schedule.

In summary, the HWR concept is based on a mature technology and workable reactor design and fuel/target cycle, with the addition of new safety systems. The MHTGR encompasses a new reactor and fuel/target technology that may suffer the usual problems common to first-of-a-kind projects. Thus, we accept the finding of the ERAB report that the HWR provides less cost and schedule risk.

Question: I understand that preliminary cost evaluations performed by the Department attempted to "normalize" the cost estimates submitted by the technology sponsors. Why was the lowest cost contingency applied to the heavy water estimates, even though the designs are the least developed, there is no current basis for safety evaluations and there have been no heavy water reactors built for over 35 years.

Answer: Reiterating some of the points discussed above:

- HWRs are the U.S.' only proven producers of tritium.
- While an HWR has not been built for many years, they have operated for many years. This experience is directly applicable.
- Some of the concepts have never been built. They are first of a kind with all risks associated with first of a kind.

These plus a number of other issues were considered in developing contingency estimates.

The new production reactor capacity contingency is not a contingency in the true cost estimator's sense. It was especially designed to consider technology and development risk, in addition to considering the level of design detail. One can have a detailed (down to the nuts and bolts) design for even the most advanced technology. However, this does not guarantee that during the development and construction program the scope and design requirements for the project will not change. It is our assessment that the safety modifications needed for the HWR should not affect markedly the proven viability and reliability of the overall production concept, hence, the technical and cost risks are less.

In addition, the baseline cost estimates for an HWR have increased over $500 million during the last few years. It has no steam/electric conversion complexities, and efforts are already well under way which will contribute to the design of a new HWR and, thus, reduce cost and schedule risks; i.e.,

- o PRA effort;
- o Emergency Core Cooling System adequacy study; and
- o severe accident study.

Question: Do you know if the recriticality issue with respect to the HWR has been resolved and verified with experimental data? If not, how long would this take? If the HWR fuel design had to be changed to overcome the recriticality concerns, could this also require a change in tritium target design? So we'd be back to square one, wouldn't we?

Answer: Recriticality is an issue for all reactor design concepts; HWR, LWR, LMR, and HTGR. The possibility exists that under the right accident conditions recriticality could occur. As such, reactor design measures are introduced to reduce the likelihood and impacts of recriticality to acceptable low levels. With respect to the current Savannah River production reactor designs, the recriticality issue was addressed in a number of papers and experiments in the mid-1960's. This information was presented in a session of the Savannah River High Flux Demonstration at the Eleventh Annual Meeting of the American Nuclear Society in Gatlinburg, Tennessee June 21, 1965. The papers concluded that "the control system was satisfactory and that the safety system provided the necessary margins of safety." Regarding the proposed NPR concepts, the recriticality issue has not yet been adequately addressed. The HWR concepts and WNP-1 were the only concepts which had performed any recriticality analysis of the actual NPR core with target assemblies.

Two of the concepts, LMR and the MHTGR, assumed there would be no recriticality problems and, therefore, provided little or no NPR specific analysis. For the HWR and the LWR concepts, two approaches to the fuel enrichment--recriticality issue--were proposed. One approach was to utilize the current Savannah River high enriched fuel and target assembly; another was to use a low enriched fuel, equivalent to current LWR fuels, to avoid the potential regulatory effort assumed to be required for the higher enriched fuel. Even for the later case, the amount of effort needed to qualify the proposed fuel assembly was assumed to be minimal since the basic materials, fuel, and target design was not significantly altered. Thus, the HWR would not be back to square one. Regarding the potential impact on the tritium target design, it should be noted that the existing design should be unaltered.

Question: In light of the fact that no entity has maintained an HWR design that is consistent with the advances of nuclear technology over the past 30 years, and the proposed HWR designs include a significant number of new design features for which there is no operating or licensing experience, and there are considerable questions regarding the severe accident reviews and analyses that must still be done, do you really believe the HWR option has the least schedule risk?

Answer: From a nuclear reactor technology viewpoint, the differences between an LWR and HWR are very well known and understood by today's reactor designers. There is, of course, work to be done in the safety design verification area and no unsolvable problems in doing so appear to exist. Our analyses indicate that the HWR option represents the least schedule risk.

Question: The ERAB report indicated that the revenues from the sale of energy can offset a significant fraction of the costs of an NPR. In considering the amount of revenues that might be available, I assume that the DOE took a conservative approach--that is, to forecast the potential revenues on the low side.

1. Is it possible that, in actual negotiations with utilities, the revenues could be significantly higher than has been assumed? In fact, I have seen figures that show a $400 million per year revenue (based on 5 cents per kwhr).

2. Isn't it true that utilities at all of the potential NPR sites have offered to buy power or steam from the plant?

3. I understand that all of the power-producing NPR designs incorporate systems that allow the reactor to continue to produce 100% of the tritium capacity even if the electrical generating plant is out of service? Would this relieve your concern about the "availability" of a power-producing NPR?

Answer: The new production reactor capacity cost evaluation includes a realistic projection for the sale of power, neither low nor high. The evaluation included findings based on an updated report entitled "The Potential Future Value of Byproduct Steam from a New Production Reactor Capacity Based on Four Alternative Technologies and Three Alternative Sites," inputs from direct contacts with the Bonneville Power Administration, The Idaho Power, South Carolina Power, and studies prepared by the Northwest Power Planning Council. In addition, the new production reactor capacity cost evaluation included partial capacity credits over and above fuel offset credits, with a higher capacity credit assigned to modular reactor designs.

1. We do not believe significantly higher revenues over what was assumed can be negotiated. To realize revenues on the order of $400 million a year, a new production reactor capacity would have to be essentially run as a baseload plant producing firm power for a utility. Even for a modular concept, such as the MHTGR, this would be difficult and could compromise the primary mission of materials production. Even with a 32 percent capacity credit, a full-size MHTGR in the Northwest can produce only $271 million a year in electric revenues. The energy credit is based on the fact that this plant would displace the burning of coal at 2.7 cents/per kilowatt hour in the Northwest.

2. Both the Idaho Power Company and the South Carolina Electric and Gas Company have expressed an interest in

participating in the power conversion side of a power producing new production reactor capacity.

3. A 100 percent steam dump does relieve most, but not all concerns about the "availability" of a power producing new production reactor capacity. The fuel/target management schemes for a production reactor will be different than for a commercial power reactor and may require more frequent reactor shutdowns. Dedicating the reactor to efficient power production could limit DP's materials production options.

Question: The ERAB noted there must be full-scale testing of the proposed LWR target and that it may be difficult to find a commercial reactor in which to test the target.

1. I understand it has been suggested that the WNP-1 plant be converted and then the target tested. Do you know of that plan? If that were to be done, what would happen if the target failed? Since the proposer intends to provide payback to the nation from electricity sales, wouldn't it be DOE's responsibility to continue to operate the WNP-1 reactor even if it were not capable of producing tritium? Is this a wise course of action?

2. I understand the recriticality issue with respect to WNP-1 is supposed to be answered by reducing enrichment in the WNP-1 by 10 percent. Has the safety analysis to confirm that been done? Can you meet tritium goals with this lower enrichment?

Answer: The ERAB noted that "final qualification of WNP-1 target rods at full-size in an LWR will likely (emphasis added) be necessary." The WNP-1 target qualifications program will provide a comprehensive approach to qualifying the target assembly. The program includes extensive out-of-pile tests and experiments that will provide all but the final validation of the target. Once these tests are complete and high confidence in the design is achieved, target refinements and optimization could be performed in the fixture in an LWR if needed. This program should produce a target that will be capable of producing tritium in the WNP-1. As the ERAB pointed out, "sufficient testing has been completed to prove the feasibility" of a high temperature target. The engineering design, production, and testing remain to be completed. The question that is raised is the economic and schedule of penalties that would accrue if there are unforeseen problems associated with the refinement process.

WNP-1 did a preliminary analysis of the recriticality issue and found that a lower enriched fuel would essentially eliminate the recriticality issue. The analysis that was presented was not as complete as a full safety analysis report evaluation of the issue. However, it provided a good point of reference for future work. The proponents analysis indicated that a 75 percent annual capacity factor was sufficient to produce goal quantities of tritium at the lower enrichment.

CONCLUSION OF HEARINGS

Senator McClure. That concludes the hearings. The subcommittee will recess and reconvene at the call of the Chair.

[Whereupon, at 12:25 p.m. Tuesday, July 26, the hearings were concluded and the subcommittee was recessed to reconvene at the call of the Chair.]

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